

ATTACHMENT PTA-XI - HYDROGEOLOGIC AND GEOTECHNICAL REPORT

As required by VAC 20-81-100, et seq., a Hydrogeologic and Geotechnical Report for the Facility has been prepared following the outline referenced in Submission Instruction No. 1 (rev. 01/2012). The report is intended to define the geology beneath the site, and the groundwater flow path and rates of the uppermost aquifer.

The Hydrogeologic and Geotechnical Report was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) was issued on April 8, 2021. Responses on TR 1 were provided to DEQ on October 1, 2021 (Comments 1 – 10, 12 -13 and 17 - 22) with a TR 1 Supplement submitted on April 13, 2022 (Comments 11, and 14-16).

DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 and issued an addendum to TR 2 on October 25, 2022 (TR 2 ADD). No comments on this attachment were received.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this attachment.

This information is incorporated here as part of the Final Part A Submission.

The following is a list of the documents associated with this section:

- **PTA Attachment XI** – Hydro Geotech Report, Green Ridge Recycling and Disposal Facility, Permit No. 626, Cumberland County, Virginia

PTA Attachment XI
Hydro Geotech Report
Green Ridge Recycling and Disposal Facility
Permit No. 626
Cumberland County, Virginia



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December 9, 2019
Final Part A Submission
August 03, 2023



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Qualified Groundwater Scientist:

I certify that I have prepared or supervised preparation of the attached report, that it has been prepared in accordance with industry standards and practices, and that the information contained herein is truthful and accurate to the best of my knowledge.

Certified this 3rd day of August, 2023

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1.0 INTRODUCTION/BACKGROUND

On behalf of Green Ridge Recycling and Disposal, LLC (GRRD), Draper Aden Associates (DAA) (now TRC) prepared this Hydrogeologic and Geotechnical Report for a proposed solid waste disposal Facility (sanitary landfill) located in Cumberland County, Virginia (Facility). This report was originally submitted to the Virginia Department of Environmental Quality – Piedmont Regional Office (DEQ) on January 22, 2020 and follows the outline requirements referenced in the DEQ's Solid Waste Permitting Submission Instruction No. 1 (rev. 01/2012).

DEQ issued Technical Review 1 (TR 1) on April 8, 2021 with subsequent responses submitted by DAA on October 1, 2021 (TR 1 response) and April 13, 2022 (TR 1 Supplement response).

DEQ issued Technical Review 2 (TR 2) on June 16, 2022 and an addendum to TR 2 on October 25, 2022. No comments on this report were received.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this report.

The purpose of this document update is to incorporate (as appropriate) the TR 1 response, to reference the TR 1 supplement response, and to provide DEQ with a Final Part A Submission.

The proposed Facility comprises 1,177.63 acres of timbered lands located in eastern Cumberland County, north of U.S. Route 60 (Anderson Highway), in the vicinity of Route 654 (Pinegrove Road) and Route 685 (Miller Lane). **PTA Attachment IX-Figure 1-Key Map** shows the location of the Facility, its boundary, and surrounding geographic features.

PTA Attachment IX-Figure 2A-Near Vicinity Map (revised) shows the Waste Management Boundary (WMB), which defines the location of future disposal areas and leachate storage facilities, and which is located west of Miller Lane. Several unnamed tributaries that bisect this portion of the Facility eventually feed into Muddy Creek.

The portion of the Facility property located east of Miller Lane will not contain any waste disposal units or leachate storage units.

In preparation of this work, the following activities were performed:

- 2018 - KBJW subsurface investigation in support of preliminary consideration of the site
- 2019 - DAA hydrogeologic study in support of the original Part A
- 2021 - DAA additional boring and CPT investigation in support of TR 1 and TR 1 supplement responses

The work completed under these investigations is discussed below.

1.1 Purpose and Methods

The purpose of this Hydrogeologic and Geotechnical Report is to characterize the hydrogeology and groundwater flow regime underlying the proposed Facility, assess the availability and suitability of on-site soils for use in constructing the landfill, and assess subsurface foundation characteristics.

Prior to the 2019 DAA hydrogeologic study, Koontz Bryant Johnson Williams (KBJW) had completed a study of the Facility location: *Preliminary Subsurface Exploration, Soil and Groundwater Study, Cumberland County, Virginia, March 12, 2018*. That report is included in Appendix 2 to this document, including its boring logs, cross sections and a potentiometric surface map. Boring logs from the KBJW report are not repeated in **PTA Attachment XII – Location of Borings and Boring Logs**, where the more recent logs for the 2019 and 2021 DAA hydrogeologic studies can be found. Similarly, the cross sections from the KBJW report are not repeated in **PTA Attachment XV**, which contains only potentiometric maps and cross sections from the DAA 2019 and 2021 hydrogeologic studies.

A variety of investigative techniques and methods were used to collect information and data as discussed under each of the following sections. The discussion that follows centers on the DAA site characterization work, with mention of how the KBJW results are utilized. For further information on methods and techniques used in the KBJW study, the reader is referred to that document, in Appendix 2.

The TR 1 supplement submittal which provided additional information for discussions on seismicity and liquefaction is referenced in Section 5.0 below with the detailed documents and discussion included in **PTA Attachment XXIII**.

This report was compiled and formatted in general accordance with the requirements of *Virginia Solid Waste Management Regulations (VSWMR)* and DEQ's Submission Instruction No. 1 *Procedural Requirements for a New or Modified Solid Waste Management Facility (SWMF) Permit Application* (Revised January 2012).

2.0 BORING RECORDS

The boring records, including number of borings, location of borings, depths of borings, sampling, boring logs, observation wells, in-situ hydraulic conductivity, and sealing of borings are presented in this section and the referenced attachments.

PTA Attachment XII-Figure BOR (TR 1 Supplement) is a 1 inch = 500 feet scale plan view of the Facility showing the Facility boundary, waste management boundary (WMB), and boring locations. **Table 1 (TR 1 Supplement) (Appendix 1)** is a summary table showing the depth, completion status, construction details and survey results for each of the borings advanced within the Facility and WMB, including those installed by KBJW. DAA Boring/Well Logs for each boring are also included in **PTA Attachment XII – Location of Borings and Boring Logs (TR 1 Supplement)**.

2.1 Number of Borings

Following initial site reconnaissance, and two meetings with the DEQ to obtain their input on the planned site characterization studies, an initial boring plan was developed. The number and layout of borings were planned to investigate a site that included two proposed disposal units totaling approximately 500 acres, bisected by a tributary to Muddy Creek. Based on the anticipated WMB, the number of borings planned across the waste management unit was consistent with Table 5.1 of 9VAC 20-81-460.E.1.a. Including the KBJW borings, a total of seventy-two (72) borings were advanced across the Facility as then planned. All borings were conducted in the conceptual disposal area, west of Miller Lane (versus along the access road portion of the site east of Miller Lane where there will be no disposal). The initial DAA field investigation concluded in May 2019.

In response to the DEQ TR 1 comments, two additional borings were completed in 2021 by DAA. These were identified as DAA-101pz and DAA-112pz. The location of the 74 borings and their boring logs are now incorporated into this report and included in Table 1.

Following the 2019 field investigation, the WMB (prior to the submittal of the original Part A) was modified for several reasons, including the avoidance of wetlands and streams, avoidance of cultural resources and adjustments of planned road relocations. The adjustment eliminated the approximate 200-acre eastern disposal area.

In 2021, the Waste Management Boundary was again modified in the response to TR 1.

The total acreage within the revised WMB (TR 1) is approximately 428 acres. Per Table 5.1 of 9VAC 20-81-460.E.1.a, for a WMB greater than 200 acres, the required number of borings is 24 plus 1 boring for each additional 10 acres beyond 200 (or an additional 23 borings for this WMB). Thus, forty-seven (47) borings are required to characterize the area within the WMB. Of the 74 borings installed, 51 of these borings are either within or immediately adjacent to the WMB or are integral to the characterization of the area within the WMB. The immediately adjacent borings include: B-6, B-17, B-20, DAA-7sb, DAA-8pz, DAA-37sb, DAA-41pz, DAA-46-pz and DAA-47-pz. The remaining 23 borings are no longer considered "Table 5.1" borings as they are no longer within

or adjacent to the WMB, nor needed to characterize the area within the WMB. However, these 23 borings still provide useful information in terms of assessing groundwater flow across the Facility, and assessing the relationship of the Facility to nearby private water wells along Miller Lane.

It should be noted that due to the adjustment of the WMB prior to submittal of the original Part A, some borings that were originally inside the WMB boundary proper, are now outside, but adjacent (e.g. DAA-37pz, B-6).

Other borings associated with characterizing the area within the WMB were specifically sited so as to provide useful geological information and a wider field of study to better characterize conditions within the WMB. This would include for example the wells just outside the southern edge of the WMB (e.g., B-17, DAA-8pz, DAA-7sb and B-20). Had these borings been sited further to the north and inside the current WMB, the information they would provide would be of lesser value and duplicative of other borings in that area, such as DAA-5pz, DAA-6pz, DAA1sb, DAA-4sb.

The line of borings near the southeastern corner of the WMB, (DAA-42pz, DAA-47pz, DAA-46pz and DAA-44 pz) were needed at these specific locations (and not within the current WMB) to better evaluate groundwater flow directions beneath the areas within and adjacent the WMB, and in this area of a groundwater divide.

Borings along the northeast corner of the WMB outside of this boundary (DAA-18pz, B-10, DAA-17sb, DAA-16pz and B-11) are essential for evaluating the groundwater flow characteristics along the northern portion of the area within the WMB. They help to evaluate how the unnamed tributary immediately to the north of the WMB may play a role in intercepting groundwater flowing north from this portion of the Facility and directing it westward toward the larger tributary bisecting the Facility.

Additional borings will be advanced around the WMB and completed as permanent monitoring wells. The location of these additional borings/wells will be identified during the Part B application process.

2.2 Location of Borings

As shown on **PTA Attachment XII-Figure BOR (TR 1 Supplement)** the boring locations targeted the major geomorphic features within the WMB. The boring distribution reflects a pattern within the WMB designed to characterize the geology and hydrogeology of the area within and adjacent the WMB. Field adjustments to the boring locations were made to target various geomorphic features, to address accessibility issues, and to avoid wetlands, streams, and potential cultural resource areas. Subsurface information from both the borings and piezometers was used to prepare four geologic cross-sections within the Facility (**PTA Attachment XV-Figure Cross-1 (TR-1 Supplement + TR 2 response)**).

2.3 Depth of Borings

All borings were advanced using hollow-stem augers. Rock cores were also collected from several of the borings using Wireline NQ2" (NQTK) rock coring equipment with a diamond tooth bit. Boring logs are included in **PTA Attachment XII** and a summary table (**Table 1**) is included in **Appendix 1** of this report.

Borings are identified using the following nomenclature, which denote the completion status:

- **DAA-2sb:** Advanced by Blue Ridge Drilling during February through March 2019, under the supervision of DAA. Boring was advanced until auger refusal or 60 to 65 feet below ground surface (bgs), whichever came first. Upon completion of drilling, borings were sealed/abandoned using hydrated bentonite pellets.
- **DAA-5pz:** Advanced by Blue Ridge Drilling during February through March 2019 and Jetco Drilling during May 2019, under the supervision of DAA. Boring was advanced until auger refusal or 55 to 60 feet bgs, whichever came first. Upon completion of drilling, 2-inch piezometers were installed by Blue Ridge Drilling and 1-inch piezometers were installed by Jetco.
- **DAA-15pz-s and DAA-15pz-d:** Boring Pairs advanced by Blue Ridge Drilling during February through March 2019, under the supervision of DAA. One boring was advanced until auger refusal and completed as a 2-inch piezometer (shallow). The second boring was advanced until auger refusal then cored an additional ten feet and completed as a 2-inch piezometer (deep).
- **B-1:** Advanced by Blue Ridge Drilling in December 2017, under the supervision of Koontz Bryant Johnson Williams (KBJW). Boring was advanced until auger refusal. Upon completion of drilling the boring was:
 - Sealed with bentonite or,
 - completed as a 1-inch piezometer or,
 - cored an additional ten feet deep and sealed with bentonite.

2.4 Sampling

Samples were logged and collected at each of the DAA borings using the following methods, frequency and rationale:

Auger Cuttings:

Auger cuttings generated during drilling were used to log and collect bulk samples at depths ranging from 0 to 6 feet below ground surface. Auger cuttings were collected from the 0 to 5-foot interval and composited as bulk samples for geotechnical analysis.

Split Spoons:

Continuous split spoon samples (per ASTM D1586-99 *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*) were collected and logged beginning at depths ranging from 2 feet to 6 feet bgs in each of the borings. A depth of 6 feet bgs was used as a conservative estimate for the proposed base grade of the disposal unit (proposed lowest elevation of solid waste disposal). Continuous split spoon samples were collected until:

- blow counts exceeded 50+/6 inches, at which time the boring was advanced at 5-foot intervals between split spoon samples until auger refusal; or
- auger refusal

Shelby Tubes:

Shelby tube samples were also collected in accordance with ASTM D1587 *Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes*. Shelby tube samples collected from several of the borings advanced within the WMB targeted depths ranging from 5 to 25 feet bgs. These target depths were selected to evaluate engineering properties such as strength and compressibility for the eventual submittal of the Part B permit application. The depths of the Shelby tube samples are shown on the boring logs.

Rock Coring:

Rock cores were collected from eleven borings. Upon auger refusal, Wireline NQ2" (NQTK) rock coring equipment with a diamond tooth bit was used to core:

- ten (10) feet into bedrock at B-2, B-3, B-6, B-18, B-20, DAA-1sb, DAA-15pz-d, DAA-19pz-d, DAA-23pz-d, and DAA-25pz-d, and
- forty (40) feet into bedrock at DAA-101pz.

The rock core samples were logged in the field and assigned a rock quality designation (RQD) value as shown on the boring logs.

All borings were logged from the surface to the termination depth as shown on the boring logs in **PTA Attachment XII**. Field classifications of the subsurface soil and rock were determined by a geologist at the time of drilling and confirmed by geotechnical laboratory testing. Results of the geotechnical laboratory testing used to confirm the field classification of the soil and rock are included in **PTA Attachment XIII – Laboratory and Field Data**.

2.5 Observation Wells

Forty-seven of the 74 borings were completed as 1-inch or 2-inch piezometers as shown on **PTA Attachment XII-Figure BOR**, and **Table 1 (Appendix 1)**. This includes four paired piezometers, which are designated as DAA-19pz-s, DAA-19pz-d, DAA-23pz-s, DAA-23pz-d, DAA-25pz-s, DAA-25pz-d, DAA-15pz-s, and DAA-15pz-d.

Potentiometric and slug test data collected from several piezometers were used to determine the rate and direction of groundwater flow across the Facility.

2.6 In-Situ Hydraulic Conductivity

In-situ single-well aquifer tests (slug tests) were performed at seven of the 2-inch piezometers. These piezometers include DAA-22pz, DAA-25pz-s, DAA-25pz-d, DAA-5pz, DAA-8pz, DAA-26pz, and DAA-29pz. DAA-25pz-d is screened in bedrock and the remaining piezometers that were slug tested are screened in overlying unconsolidated materials. Both slug-in and slug-out tests were performed on all seven piezometers. Slug test data was analyzed to determine hydraulic conductivity (K) using the Bouwer and Rice (1976) or Bouwer (1989) methods of analysis. Aqtesolv computer software was used to facilitate the calculations. Test results from the piezometers screened in unconsolidated material indicated hydraulic conductivity values ranging from 1.20×10^{-1} feet per day (ft/day) to 3.82×10^{-1} ft/day, with an average value of 2.45×10^{-1} ft/day. Based on the test results performed on DAA-25pz-d (screened in bedrock), the hydraulic conductivity value was 1.36×10^{-1} ft/day. Test data and calculations are included in **PTA Attachment XIII**.

2.7 Sealing of Borings/Well Abandonment

Boreholes that were not converted to piezometers were abandoned upon completion of drilling using hydrated bentonite pellets. Piezometers located within the proposed WMB that will not be converted to a permanent monitoring well will be abandoned prior to construction of the Facility. The abandonment procedures will follow then-current written DEQ guidance. Currently acceptable monitoring well abandonment procedures include:

1. DEQ will be notified of any monitoring well, observation well or piezometer abandonment activities.
2. The ground surface completion will be removed.
3. The entire well bore will be over drilled to remove all casing, sand filter pack material and grout. Additionally, the resulting open borehole will be backfilled using a tremie pipe with a type I Portland cement and bentonite grout containing 5% by volume bentonite.
4. The monitoring well will be filled with a type 1 Portland cement grout and bentonite containing 5% by volume bentonite from the bottom of the well using a tremie pipe. The bentonite prevents the grout mixture from shrinking while curing, thus providing a good seal in the abandoned borehole to minimize formation of preferential flow paths.

3.0 GEOTECHNICAL REPORT

3.1 Description of Soil Units

PTA Attachment XII (and KBJW report in Appendix 2) contain the boring logs that represent the subsurface conditions encountered during the subsurface investigation conducted at the Facility. Soil strata inferences, discussed below and indicated on the boring logs, represent an estimate of the subsurface conditions based on visual classifications of soils and laboratory classification test results. Note that the transitions between soil strata are generally less distinct than shown on the boring logs and are interpolated between the boring locations. For specific subsurface soil information refer to the boring logs.

The following overall soil strata were observed during the DAA subsurface drilling investigation:

Stratum S1: Stratum S1 material consisted of fine-to coarse-grained Clayey SAND (SC), fine-grained Elastic SILT (MH), and Clayey fine SAND (ML). The Stratum S1 material extended to depths ranging from 2 to 63.5-feet below existing grade, was observed to be light brown to reddish-brown in color, damp to wet, and exhibited N-values ranging from 4 to 25 blows per foot (bpf).

Stratum S2: Stratum S2 material consisted of fine- to coarse-grained Silty SAND (SM) with varying degrees of plasticity. The material extended to a depth ranging from 2 to 48 feet below existing grade, was observed to be light brown and reddish-brown to brownish-gray in color, damp to moist, and exhibiting N-values ranging from 2 to 66 bpf.

Stratum S3: Stratum S3 material consisted of saprolite (partially weathered rock). Saprolite is a transitional material between soil and rock, with hard to very dense relative densities. The material extended to boring termination at depths ranging from 2 to 55 feet below grade, was observed to be light brown to gray in color, damp to wet, and exhibiting N-values ranging from 48 to greater than 100 bpf.

3.2 Laboratory Results

The soil samples obtained during the field investigation were placed in labeled sample containers that were sealed to reduce moisture loss. The rock core samples were stored in core boxes. Field samples were transported to DAA's U.S. Army Corps of Engineers Qualified Materials Testing Laboratory for further testing. The testing items and related ASTM standards are listed below:

Test Item	Standard Name
Soil Natural Moisture Contents	ASTM D2216
Atterberg Limits	ASTM D4318
Soil Classification	ASTM D2487
Standard Proctor Test	ASTM D698
Hydraulic Conductivity	ASTM D5084

A table summarizing the testing results listed above and detailed laboratory reports are presented in **PTA Attachment XIII**.

3.2 Remolded Hydraulic Conductivity

Although it is not intended to use the onsite soil material for a drainage layer, impermeable cap or an impermeable liner, remolded hydraulic conductivity testing was performed on composite bulk samples collected from the upper 0 to 5 feet at various locations across the Facility. The test samples were prepared according to ASTM D698, Standard Proctor, and ASTM D5084. The results of the remolded hydraulic conductivity tests ranged from 1.0×10^{-7} to 7.6×10^{-8} cm/sec.

3.3 Volume of Materials

As required by §9 VAC 20-81-460.E.2.b.(3), calculations supporting the estimate of soil materials required for development and operation of the landfill are provided in **PTA Attachment XIV – Material Volume Calculations (TR 2)**. On-site soil materials will be used for structural fill, bedding layers, upper layers of closure cap, intermediate cover and limited operations. On-site soils will not be used for liner or the infiltration layer component of the cap. A geosynthetic clay liner will be used in lieu of clay soil materials. Green Ridge will use alternate daily covers in lieu of the 6" soil for daily cover where appropriate.

Based on preliminary calculations as provided in the referenced attachment, approximately 9.2M cubic yards (cy) will be needed for construction and operations. Significant soil material will be generated from excavation during landfill development. (estimated to be 4.8M cy) In addition, it is estimated that significant soils can be borrowed from on-site borrow areas primarily in the eastern side of the property (estimated to be 4.4M cy)

Note that the calculations indicate a slight deficit of 84,000 cubic yards. This would be equivalent to approximately 10 additional acres of borrow at an average depth of 5' of excavation. Given the additional acreage on site and the adjacent properties owned by Green Ridge this deficit should be readily addressed within the Facility Boundary or from other properties under control of the applicant.

4.0 HYDROGEOLOGIC REPORT

4.1 Water Table Information

Forty-seven (47) of the seventy-four (74) borings were completed as piezometers. The top of casing elevation for each piezometer (both DAA and KBJW piezometers) was surveyed to within 0.10 feet by a licensed surveyor. Construction details for the piezometers are shown on the boring logs in **PTA Attachment XII**, in the KBJW Report (**Appendix 2**), and in **Table 1 (Appendix 1)**.

4.2 Groundwater Level Measurements

DAA collected groundwater level measurements from the piezometers in April 2019, May 2019, October 2019, January 2020, March 2020, June 2020, July 2020, August 2020, October 2020, January 2021, March 2021, December 2021, March 2022, and June 2022. No purging or sampling activities were conducted within the 24 hours preceding the measuring activities, so that measured water levels would be representative of actual field conditions. Static water levels were measured with an electronic water level indicator, accurate to 0.01 feet. These measurements were obtained from a surveyed mark on top of each casing to ensure consistency. The results of these measurements are shown on **Table 1A (Appendix 1)**. Based on the numerous events, the May 2019 event is most representative of the site and groundwater level measurements.

Potentiometric maps for the May 2019 and October 2019 are included in **PTA Attachment XV**.

4.3 Vertical Flow Components

May 31, 2019 - As discussed in Section 2.5 of this report, four pairs of piezometers were installed during the hydrogeologic study. As shown in **Table 1 (Appendix 1)**, groundwater elevations measured in feet above mean seal level, observed on May 31, 2019 in the four pairs of piezometers were:

- 308.26 DAA-19pz-s ▪ 294.27 DAA-23pz-s ▪ 304.90 DAA-25pz-s ▪ 307.07 DAA-15pz-s
- 308.29 DAA-19pz-d ▪ 292.41 DAA-23pz-d ▪ 305.75 DAA-25pz-d ▪ 307.09 DAA-15pz-d

Vertical gradient was calculated for each pair by dividing the difference in groundwater elevation between the shallow piezometer and the deep piezometer by the vertical difference between the midpoint of the relative screens, or:

$$\frac{(\text{Groundwater Elevation Shallow Piezometer}) - (\text{Groundwater Elevation Deep Piezometer})}{\text{Difference of mid-screen depths between Shallow and Deep Piezometers}}$$

Results showed an overall upward gradient in all the piezometer pairs except the DAA-23pz location. The DAA-23pz pair showed a minimal downward hydraulic gradient.

October 29, 2019 - As shown on **Table 1**, groundwater elevations observed on October 29, 2019, in the four pairs of piezometers were:

- | | | | |
|---------------------|---------------------|---------------------|---------------------|
| ▪ 305.54 DAA-19pz-s | ▪ 291.41 DAA-23pz-s | ▪ 302.45 DAA-25pz-s | ▪ 305.95 DAA-15pz-s |
| ▪ 304.89 DAA-19pz-d | ▪ 294.85 DAA-23pz-d | ▪ 302.65 DAA-25pz-d | ▪ 306.04 DAA-15pz-d |

Vertical gradient was calculated for each pair by dividing the difference in groundwater elevation between the shallow piezometer and the deep piezometer by the vertical difference between the midpoint of the relative screens, or:

$$\frac{(\text{Groundwater Elevation Shallow Piezometer}) - (\text{Groundwater Elevation Deep Piezometer})}{\text{Difference of mid-screen depths between Shallow and Deep Piezometers}}$$

Results showed an overall upward gradient in the piezometer pairs of DAA-23pz and DAA-25pz. The DAA-15pz and DAA-19pz pairs showed a downward hydraulic gradient.

4.4 Seasonal and Temporal Factors

Infiltration from precipitation as a factor of seasonal fluctuations in total rainfall and rainfall intensity, likely affect the static groundwater elevations in the uppermost aquifer at the site. Monthly precipitation data from July 2018 through June 2019 is presented on **Table 2 (Appendix 1)**. Limited data exists at this time regarding the response of groundwater elevations at the Facility to precipitation. Additional data may be collected during future monitoring events until such time that a correlation may be established.

It should be noted that base grades as shown in the cross sections contained in **PTA Attachment XV**, are shown as set off of the highest groundwater elevations beneath the proposed disposal area as observed during the May 2019 gauging event. As shown on Table 1, seasonal water table fluctuations beneath the disposal area range from approximately 3 to 6 feet.

Currently, no apparent temporal or anthropogenic factors that could affect groundwater levels at the Facility are occurring. Such factors might include on-site pumping of wells or pumping of high-yielding offsite wells.

4.5 Field Procedures and Results

As stated in the previous section describing hydraulic conductivity testing, in-situ single-well aquifer tests (slug tests) were performed at seven of the 2-inch piezometers. These piezometers include DAA-22pz, DAA-25pz-s and DAA-25pz-d, DAA-5pz, DAA-8pz, DAA-26pz and DAA-29pz. DAA-25pz-d is screened in bedrock and the remaining piezometers that were slug tested are screened in overlying unconsolidated materials. Both slug-in and slug-out tests were performed on all seven piezometers. Slug test data was analyzed to determine hydraulic conductivity (K) using the Bouwer and Rice (1976) or Bouwer (1989) methods of analysis. Aqtesolv computer software was used to facilitate the calculations. Test results from the piezometers screened in unconsolidated material indicated hydraulic conductivity values ranging from 1.20×10^{-1} feet per day (ft/day) to 3.82×10^{-1} ft/day, with an average value of 2.45×10^{-1} ft/day. Based on the test

results performed on DAA-25pz-d (screened in bedrock), the hydraulic conductivity value was 1.36×10^{-1} ft/day. Test data and calculations are presented in **PTA Attachment XIII**.

4.6 Description of Site Geology

The Facility is located within the Piedmont province, which is the largest physiographic province in Virginia. Virginia's Piedmont province is characterized by gently rolling topography and extends from the Blue Ridge Mountains on the west to the Coastal Plain Province on the east. Bedrock within the Piedmont province generally consists of hard, resistant igneous rock and metamorphosed igneous and sedimentary rock, although minor sedimentary basin deposit formations are also present. Bedrock within the Piedmont province is typically overlain by unconsolidated regolith. A significant portion of the regolith is typically comprised of saprolite, which is a soft, decomposed rock created by chemical weathering of the uppermost bedrock surface. Saprolite within the Piedmont province is variably thick and can exceed 60 feet in thickness. Outcrops are commonly restricted to stream valleys where saprolite has been removed by erosion.

Based on a review of the *Geologic Map of Virginia* prepared by the United States Geologic Survey (USGS, 1993), the Facility is underlain by Proterozoic light gray segregation-layered gneiss containing prominent potassium feldspar porphyroblasts (see **PTA Attachment XV-Geologic Map**). Typical mineralogy is quartzite, biotite, plagioclase, potassium feldspar, muscovite and hornblende. Bedrock outcrops are visible in stream beds at various locations across the Facility and observations of these outcrops confirm the site is in fact underlain by fractured gneiss.

During drilling activities at the Facility, bedrock was encountered at depths ranging from 8 feet bgs in DAA-45pz to depths of greater than 60 feet bgs in DAA-4sb and DAA-7b. A bedrock surface contour map is included in **PTA Attachment XV as Figure BED (TR 1 Supplement)**. As shown on **Table 1 (TR 1 Supplement)** and the boring logs in **Attachment XII**, eleven rock core samples were collected. Ten (10) feet of cored rock (two 5-foot runs) were collected from each of the following boring locations: B-2, B-3, B-6, B-18, B-20, DAA-1sb, DAA-15pz-d, DAA-19pz-d, DAA-23pz-d and DAA-25pz-d. The Rock Quality Designation (RQD) results ranged from 13% (highly weathered) in the upper 5-foot run in B-18 to 98% (competent) in the lower 5-foot run in B-2.

Forty (40) feet of cored rock (eight 5-foot runs) were collected from DAA-101pz installed in response to TR 1 comments. RQD results ranged from 27% (highly weathered) in the upper 10 feet of rock core in DAA-101pz, to 92% (competent) in the lower 10 feet of rock core in DAA-101pz.

Consistent with the regional geology literature for the Piedmont province in this area of Virginia, the core samples indicate the Facility is predominantly underlain by a biotite rich gneiss with intermittent quartz seams/intrusions. This type of rock is typically not conducive to solution activity, although it is likely to contain fractures and fracture zones, which have contributed to the formation of existing depressions and stream channels across the site.

The Part A subsurface investigation indicated geology beneath the Facility is generally consistent with characteristics typical of the Piedmont province (rolling topography, weathered bedrock underlying a blanket of unconsolidated and saprolitic materials, and shallower depths to bedrock in stream valleys where overlying material has been removed by erosion). Site soils are predominantly composed of unconsolidated sands and silts, with lesser deposits of silty clays. Saprolites and remnant rock fabric were typically observed in unconsolidated soils throughout the site. Soils are typically thicker on the topographically elevated areas, and thinner in the stream valleys. Observed thickness ranged from greater than 60 feet thick in DAA-7sb, which is located at the southern (upgradient) portion of the Facility, to 8 feet thick in DAA-45pz, which is located at the northern (downgradient) portion of the Facility near Muddy Creek. Cross-sections are presented in **PTA Attachment XV**.

The uppermost aquifer zone is predominantly located in the materials overlying the bedrock. However, as discussed in more detail in the following section, the water table extends to below the bedrock surface at the downgradient portion of the Facility where unconsolidated soils thin toward Muddy Creek. Flow of groundwater in bedrock primarily occurs in the upper weathered portions, and not the underlying, less weathered, and more competent portions. No structural discontinuities that would affect groundwater flow were noted during the subsurface investigation.

4.7 Description of Aquifer

The findings of the Part A subsurface investigation have characterized the directions of groundwater flow within the uppermost aquifer. As stated above, and as presented in **PTA Attachment XV**, the uppermost aquifer is predominantly located in the pore space available in the soils and saprolite materials overlying the bedrock. These materials are predominantly granular permeable materials including fine to medium sands and silts, with lesser amounts of silty clays.

Recharge areas on the Facility coincide with most topographically elevated areas where permeable granular materials are exposed at the surface. In these areas, infiltrated precipitation is the primary source of recharge.

Potentiometric surface maps prepared from groundwater elevation data collected in May and October 2019 are shown in **PTA Attachment XV-Figures GW-1 and GW-2**. Groundwater flow direction is presumed to be perpendicular to the interpolated groundwater elevation contours. As shown on the potentiometric surface maps, groundwater flow across the Facility is generally north-northwest toward Muddy Creek. This flow pattern is likely caused by the effect of the topography, the geometry of the underlying bedrock, and localized stream beds that dissect the Facility. The majority of groundwater flow occurs in the unconsolidated materials overlying the bedrock. Comparison of potentiometric elevations to bedrock elevations indicate that the water table appears to extend below the bedrock surface at the north-northwest portion of the Facility closer to Muddy Creek.

Potentiometric gradients (i) range from approximately 7.94×10^{-3} in the southern most upgradient section of the Facility to 2.92×10^{-2} in the central downgradient portion of the Facility. As previously discussed, in-situ single-well aquifer tests (slug tests) were performed on selected piezometers. Based on the slug tests, the average hydraulic conductivity (K) of the unconsolidated materials was 0.245 ft/day. Assuming an effective porosity (n) of 0.30, (McWorter and Sunada, 1977) the average seepage velocity for the upgradient portion of the Facility, where the shallower gradient was estimated, is calculated as follows:

$$V = Ki/n$$

$$V = (0.245 \text{ ft/day}) (7.94 \times 10^{-3}) / 0.30$$

$$V = 6.48 \times 10^{-3} \text{ ft/day}$$

The average linear velocity for the downgradient portion of the Facility, where the steepest gradient was estimated, is calculated as follows:

$$V = Ki/n$$

$$V = (0.245 \text{ ft/day}) (2.92 \times 10^{-2}) / 0.30$$

$$V = 2.38 \times 10^{-2} \text{ ft/day}$$

As previously discussed, paired piezometers were installed in the overburden and bedrock material. Comparison of these observed elevations indicates that the uppermost aquifer comprises both the shallow unconsolidated materials and the deeper, weathered upper portions of bedrock.

Summary of Findings: To summarize the site geology and hydrogeology at the proposed Facility as it pertains to groundwater monitoring and conduciveness to corrective actions, if warranted, the findings of the Part A subsurface investigation indicated the following:

- Most of the uppermost aquifer occupies the pore space within the saprolite material overlying bedrock at the Facility. These materials are predominantly fine to medium sands and silts, with lesser amounts of silty clays.
- Some portions of the uppermost aquifer are located at or below the bedrock surface at topographically elevated areas immediately upgradient of Muddy Creek.
- Flow of groundwater in bedrock primarily occurs in the upper weathered rock, however deeper groundwater flow in bedrock is likely occurring as well (below the elevation of the investigation) with this deeper flow controlled by fracture zones in the bedrock. These fracture zones often correlate with stream valleys. Permanent monitoring wells will be installed to monitor this deeper flow system as well as the shallower bedrock (saprolite) and overburden flow systems.

- No faults or other structural discontinuities that would complicate groundwater flow or monitoring were noted during the investigation.
- The soil and rock types, as well as groundwater flow patterns observed during the investigation indicate the site geology and hydrogeology are conducive for the uppermost aquifer to be characterized and effectively monitored.
- Site conditions indicate that a monitoring well network can be designed and installed to monitor the landfill.

5.0 TR 1 SUPPLEMENT – ADDITIONAL ACTIVITIES AND SCHNABEL REPORT

5.1 Background

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued by DEQ on April 8, 2021. TR 1 had 22 comments.

One comment (Comment 11) required additional response on bedrock. Comment as follows:

11.)The proposed base grades depicted in Attachment XV of the Part A Permit Application show the base grades constructed 10 to 25 feet into the bedrock in some areas (e.g., South of B-5, and near DAA-27sb). However, it appears that none of the borings performed for the Part A Permit Application were installed more than 10 feet into bedrock at the site. In accordance with 9 VAC 20-81-460.E.1.e., at least one deep boring should be installed into bedrock where the deepest base grades are proposed. The bedrock should be cored continuously for the first 20 feet below the proposed base grade. This will provide necessary information in accordance with 9 VAC 20-81-120.D.1 regarding the rate and direction of groundwater flow in the bedrock, ability to monitor groundwater in bedrock, the need for blasting or adjustment of base grades, potential hydraulic inter-connection with other regional groundwater wells, etc.

Three of the comments (Comments 14, 15 and 16) specifically related to seismic zones and design (i.e., Ground Shaking Hazard Levels and Landfill Containment Structure Design Considerations). Comments as follows:

14.)The proposed landfill is located within the Central Virginia Seismic Zone. 9 VAC 20-81-120.C.3.b.(1) restricts siting of a landfill within a seismic impact zone unless the owner or operator demonstrates that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material for the site. Attachment XXIII indicates that the peak ground acceleration may be as much as 20% gravity for the landfill site. However, according to the USGS Unified Hazard Tool, the peak ground acceleration to be used for design purposes at this site location is 22.5% gravity, or 0.225g. Please note that the USGS updated the U.S. Seismic Hazard Long-Term Model in 2018. The applicant should use the updated data as appropriate in the Part A Permit Application.

15.)The proposed base grades depicted in Attachment XV of the Part A Permit Application are shown constructed into the bedrock in some areas, and atop as much as 35 feet of silts and sands in other areas of the site. Attachment XXIII indicates that the proposed landfill will incorporate a design seismic coefficient of 0.10g, or one-half the peak ground acceleration. However, it is not appropriate to set the seismic coefficient as one-half the peak bedrock acceleration at this stage, since the seismic coefficient is related to the peak acceleration at the ground surface, which may be amplified by the overlying soils and be different than the peak acceleration in bedrock.

16.) *An assessment of the Liquefaction Potential should be performed based upon the geotechnical and hydrogeological data gathered from the site investigations (in particular in those areas with more extensive silts and sands, e.g., DAA-4sb and DAA-36pz). In addition, a preliminary seismic stability analysis should be performed for both conditions that may be present (i.e., landfill constructed into bedrock, and landfill constructed atop 35 feet or more of silts and sands), in order to demonstrate that the landfill can be designed to resist the maximum horizontal acceleration in bedrock, as required by 9 VAC 20-81-120.C.3.b.(2). Guidance for performing these assessments can be found in document EPA/600/R-95/051, RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.*

Green Ridge's responses to the TR 1 comments were addressed in two phases:

- Phase 1 was a response to all comments although the responses to Comment 11 (deep boring into bedrock), and Comments 14, 15, and 16 indicated that additional field work with technical evaluation was necessary to provide the requested information. In support of this effort, the response indicated that Schnabel Engineering had been retained by Green Ridge to address Comments 14 through 16. The Phase 1 response was submitted to DEQ on October 1, 2021 and included Letter Attachment 12 which contained a preliminary memorandum from Schnabel Engineering dated August 26, 2021
- Phase 2 was submitted on April 13, 2022 as a supplement to the October 1, 2021 submittal and provided the results of the required additional field investigations and technical evaluation. This submittal is termed TR 1 Supplement response. Key to this submittal was a final report by Schnabel Engineering dated April 8, 2022 which fully addressed responses to Comments 14 through 16.

5.2 Overview of Activities

A brief description of the activities under Phase 2 follows. Detailed information can be found in **PTA Attachment XXIII**.

Relative to bedrock: On November 30, 2021, DAA supervised the drilling and installation of a deep boring/piezometer DAA-101pz. DAA-101pz was installed at the northern section of the disposal cell, adjacent to existing soil boring B-9. The north section of the disposal cell is where the deepest conceptual base grades were proposed. DAA-101pz was advanced by Blue Ridge Drilling using hollow stem augers. Upon auger refusal at approximately 15 feet below ground surface (bgs), Wireline NQ2 rock coring equipment was used to core bedrock continuously from 15 feet to 55 feet bgs. Rock core samples were logged in the field and assigned a rock quality designation (RQD) value. Upon completion of rock coring activities, DAA-101pz was completed as a 2-inch diameter piezometer.

Groundwater gauging data was collected from the piezometers at the facility in December 2021 and March 2022. As shown in Table 1, the groundwater elevation in DAA-101pz is 291 feet msl, which is just below the overburden/bedrock interface in this area of the disposal cell.

Based on the additional field work and analysis, the DEQ TR 1 Comment Number 11 was adequately addressed as there were no further comments relative to these comments included in TR 2.

Relative to seismicity and liquefaction: Cone penetration testing including seismic CPTs were needed to verify underlying conditions. The cone penetration test (CPT) is a method used to determine the geotechnical engineering properties of soils and delineating soil stratigraphy. In this test a cone penetrometer is pushed into the ground at a standard rate and data are recorded at regular intervals during penetration. A cone penetration test rig pushes the steel cone vertically into the ground. The cone penetrometer is instrumented to measure penetration resistance at the tip and friction in the shaft (friction sleeve) during penetration. It is standardized under ASTM standard D 3441 (2004). ConeTec completed this work during November 2021 and 11 CPT soundings were completed. DAA-112pz was also constructed in support of this activity. The information from this testing can be found in **PTA Attachment XXIII**.

Boring logs for DAA 101pz and DAA 112pz can be found in **PTA Attachment XII**.

Based on the additional field work and analysis, the DEQ TR 1 Comments 14 – 16 were adequately addressed as there were no further comments relative to these comments included in TR 2 or the June 29, 2023 DEQ comments.

6.0 REFERENCES

Bouwer, H., 1989. The Bouwer and Rice slug test-an update, *Ground Water*, vol. 27, no. 3, pp. 304-309.

Bouwer, H. and R.C. Rice, 1976. *A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells*, *Water Resources Research*, vol. 12, no. 3, pp. 423-428.

McWorter, D. B., and Sunada, D. K. 1977. *Ground-Water Hydrology and Hydraulics*, Water Resources Publications, LLC.

USGS, 1993. *Geologic Map of Virginia*. Prepared by the Virginia Division of Mines, Mineral and Energy.

VSWMR, 2012. *Virginia Solid Waste Management Regulations - Procedural Requirements for a New or Modified Solid Waste Management Facility Permit Application* (Revised January 2012).

APPENDIX HG-1

TABLES

TABLE 1 (Revised April 12, 2022 - light green cells)

Boring Log Completion Details
Groundwater and Bedrock Elevation Data
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

Boring ID	Completion Date	Auger Refusal Depth (ft bgs)	Rock Core Depth (ft bgs)	Current Status	Depth to Groundwater (feet above mean sea level)			Well/Boring Elevations				Groundwater Elevations			Proposed Base Grade Elevation	Bedrock Elevation
					04/11/19	05/31/19	10/29/19	Top of Casing	Top of Screen	Bottom of Screen	Ground Surface	04/11/19	05/31/19	10/29/19		
B-1	11/30/17	51	-	1" Piezometer	37.06	36.14	36.65	375.59	339.63	323.63	374.63	338.53	339.45	338.94	343.88	323.63
B-2	11/30/17	32	32 to 42	Sealed Boring	-	-	-	-	-	-	358.28	-	-	-	336.72	326.28
B-3	12/01/17	25.5	25.5 to 35.5	1" Piezometer	19.90	19.40	20.06	348.89	312.33	322.33	347.83	328.99	329.49	328.83	330.84	322.33
B-4	12/01/17	25.5	-	Sealed Boring	-	-	-	-	-	-	329.63	-	-	-	311.74	304.13
B-5	12/04/17	10	-	Sealed Boring	-	-	-	-	-	-	315.00	-	-	-	na	305.00
B-6	12/12/17	40	40 to 50	Sealed Boring	-	-	-	-	-	-	355.46	-	-	-	na	315.46
B-7	12/05/17	55	-	1" Piezometer	31.78	30.53	31.84	353.71	312.33	297.33	352.33	321.93	323.18	321.87	na	297.33
B-8	12/04/17	36	-	1" Piezometer	36.15	35.15	35.20	331.21	304.26	294.26	330.26	295.06	296.06	296.01	na	294.26
B-9	12/01/17	21	-	Sealed Boring	-	-	-	-	-	-	310.55	-	-	-	296.59	289.55
B-10	12/05/17	47	-	1" Piezometer	29.72	29.19	30.10	342.16	309.19	294.19	341.19	312.44	312.97	312.06	na	294.19
B-11	12/05/17	40	-	Sealed Boring	-	-	-	-	-	-	320.32	-	-	-	na	280.32
B-12	12/06/17	40	-	1" Piezometer	10.82	13.08	19.55	337.01	315.89	295.89	335.89	326.19	323.93	317.46	na	295.89
B-13	12/07/17	25	-	Sealed Boring	-	-	-	-	-	-	332.58	-	-	-	na	307.58
B-14	12/07/17	42.5	-	1" Piezometer	30.34	31.16	33.87	291.89	258.00	248.00	290.50	261.55	260.73	258.02	na	248.00
B-15	12/08/17	11	-	Sealed Boring	-	-	-	-	-	-	265.88	-	-	-	na	254.88
B-16	12/08/17	30	-	Sealed Boring	-	-	-	-	-	-	320.00	-	-	-	na	290.00
B-17	11/12/17	47	-	1" Piezometer	31.38	30.15	30.99	383.46	354.37	334.37	381.37	352.08	353.31	352.47	na	334.37
B-18	12/14/17	30	30 to 40	1" Piezometer	13.81	13.94	16.60	366.17	350.42	325.42	365.42	352.36	352.23	349.57	350.80	335.42
B-19	12/13/17	46.5	-	Sealed Boring	-	-	-	-	-	-	363.66	-	-	-	na	317.16
B-20	12/15/17	38	38 to 48	1" Piezometer	34.65	34.05	34.90	349.61	316.15	301.15	349.15	314.96	315.56	314.71	na	311.15
DAA-1sb	02/21/19	21.5	21.5 to 31.5	Sealed Boring	-	-	-	-	-	-	348.25	-	-	-	333.52	326.75
DAA-2sb	02/25/19	51.5	-	Sealed Boring	-	-	-	-	-	-	355.61	-	-	-	324.80	304.11
DAA-3sb	02/25/19	> 62	-	Sealed Boring	-	-	-	-	-	-	348.39	-	-	-	336.21	< 286.39
DAA-4sb	02/26/19	39	-	Sealed Boring	-	-	-	-	-	-	347.44	-	-	-	344.21	308.44
DAA-5pz	02/26/19	35.5	-	2" Piezometer	20.32	19.56	21.25	356.50	325.99	320.99	356.49	336.18	336.94	335.25	339.97	320.99
DAA-6pz	02/26/19	23.5	-	2" Piezometer	18.25	18.13	21.20	335.19	314.42	309.42	332.92	316.94	317.06	313.99	327.60	309.42
DAA-7sb	02/27/19	63.5	-	Sealed Boring	-	-	-	-	-	-	352.90	-	-	-	na	289.40
DAA-8pz	02/27/19	36	-	2" Piezometer	8.47	9.59	13.55	365.46	338.19	328.19	364.19	356.99	355.87	351.91	na	328.19
DAA-9pz	02/28/19	25	-	2" Piezometer	19.89	19.71	21.70	365.68	350.25	340.25	365.25	345.79	345.97	343.98	351.02	340.25
DAA-10pz	02/28/19	31	-	2" Piezometer	22.95	22.66	24.60	341.55	313.45	308.45	339.45	318.60	318.89	316.95	323.74	308.45
DAA-11pz	02/28/19	23	-	2" Piezometer	dry	23.75	dry	336.30	317.07	312.07	335.07	Dry	312.55	Dry	na	312.07
DAA-12pz	03/04/19	25.5	-	2" Piezometer	22.34	22.35	26.00	331.20	309.57	304.57	330.07	308.86	308.85	305.20	313.28	304.57
DAA-13pz	03/04/19	34	-	2" Piezometer	24.82	24.66	27.05	359.36	328.96	323.96	357.96	334.54	334.70	332.31	337.19	323.96
DAA-14pz	03/05/19	42	-	2" Piezometer	36.79	35.75	35.30	381.44	343.13	338.13	380.13	344.65	345.69	346.14	350.44	338.13
DAA-15pz-s	03/05/19	34	-	2" Piezometer	24.53	24.08	25.20	331.15	300.98	295.98	329.98	306.62	307.07	305.95	311.69	295.98
DAA-15pz-d	03/05/19	29	29 to 39	2" Piezometer	24.72	24.25	25.30	331.34	300.71	290.71	329.71	306.62	307.09	306.04	na	300.71
DAA-16pz	03/06/19	26	-	2" Piezometer	21.68	27.57	dry	324.60	302.02	297.02	323.02	302.92	297.03	Dry	na	297.02
DAA-17sb	03/06/19	22.5	-	Sealed Boring	-	-	-	-	-	-	332.69	-	-	-	na	310.19
DAA-18pz	03/07/19	27	-	2" Piezometer	17.68	18.26	21.83	343.46	320.12	315.12	342.12	325.78	325.20	321.63	na	315.12
DAA-19pz-s	03/07/19	21.5	-	2" Piezometer	17.00	17.68	20.40	325.94	308.84	303.84	325.34	308.94	308.26	305.54	na	303.84
DAA-19pz-d	03/11/19	23	23 to 33	2" Piezometer	18.17	18.80	22.20	327.09	306.18	296.18	325.18	308.92	308.29	304.89	na	302.18
DAA-20pz	03/11/19	34	-	2" Piezometer	dry	dry	dry	313.62	283.39	278.39	312.39	Dry	Dry	Dry	na	278.39
DAA-21sb	03/12/19	47	-	Sealed Boring	-	-	-	-	-	-	315.47	-	-	-	na	268.47

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					04/11/19	05/31/19	10/29/19	Top of Casing	Top of Screen	Bottom of Screen	Ground Surface	04/11/19	05/31/19	10/29/19		
DAA-22pz	03/12/19	> 55	-	2" Piezometer	37.55	35.86	35.48	324.70	278.33	268.33	323.33	287.15	288.84	289.22	na	< 268.33
DAA-23pz-s	03/13/19	33	-	2" Piezometer	28.59	26.34	29.20	320.61	290.63	285.63	318.63	292.02	294.27	291.41	na	285.63
DAA-23pz-d	03/13/19	37	37 to 47	2" Piezometer	27.98	26.26	23.82	318.67	280.94	270.94	317.94	290.69	292.41	294.85	na	280.94
DAA-24pz	03/13/19	23	-	2" Piezometer	22.33	20.27	20.40	291.19	271.87	266.87	289.87	268.86	270.92	270.79	na	266.87
DAA-25pz-s	03/14/19	37	-	2" Piezometer	23.55	23.55	26.00	328.45	294.38	289.38	326.38	304.90	304.90	302.45	na	289.38
DAA-25pz-d	03/14/19	37	37 to 47	2" Piezometer	21.88	21.95	25.05	327.70	289.58	279.58	326.58	305.82	305.75	302.65	na	289.58
DAA-26pz	03/27/19	48	-	2" Piezometer	28.76	28.07	28.86	305.08	261.20	256.20	304.20	276.32	277.01	276.22	na	256.20
DAA-27sb	03/27/19	21.5	-	Sealed Boring	-	-	-	-	-	-	331.70	-	-	-	305.90	310.20
DAA-28sb	03/28/19	44	-	Sealed Boring	-	-	-	-	-	-	320.28	-	-	-	307.20	276.28
DAA-29pz	03/28/19	34.5	-	2" Piezometer	20.91	20.63	25.60	349.41	318.34	313.34	347.84	328.50	328.78	323.81	326.39	313.34
DAA-30sb	03/28/19	31	-	Sealed Boring	-	-	-	-	-	-	339.93	-	-	-	319.28	308.93
DAA-31pz	03/29/19	33.5	-	2" Piezometer	31.64	31.04	32.20	349.92	320.07	315.07	348.57	318.28	318.88	317.72	321.24	315.07
DAA-32sb	03/29/19	31	-	Sealed Boring	-	-	-	-	-	-	349.82	-	-	-	321.78	318.82
DAA-33sb	04/02/19	17	-	Sealed Boring	-	-	-	-	-	-	348.20	-	-	-	338.98	331.20
DAA-34pz	04/02/19	39.5	-	2" Piezometer	27.65	25.91	26.75	355.38	320.20	315.20	354.70	327.73	329.47	328.63	338.48	315.20
DAA-35pz	04/03/19	38	-	2" Piezometer	31.58	30.95	32.00	367.36	332.58	327.58	365.58	335.78	336.41	335.36	340.89	327.58
DAA-36pz	04/03/19	45	-	2" Piezometer	10.25	10.64	14.04	340.83	300.15	295.15	340.15	330.58	330.19	326.79	na	295.15
DAA-37sb	04/04/19	47.5	-	Sealed Boring	-	-	-	-	-	-	357.48	-	-	-	na	309.98
DAA-38sb	04/04/19	19.5	-	Sealed Boring	-	-	-	-	-	-	307.43	-	-	-	na	287.93
DAA-39sb	04/04/19	25.5	-	Sealed Boring	-	-	-	-	-	-	315.21	-	-	-	na	289.71
DAA-40pz	04/05/19	29	-	2" Piezometer	25.94	26.83	dry	327.50	301.93	296.93	325.93	301.56	300.67	Dry	na	296.93
DAA-41pz	04/08/19	22.5	-	2" Piezometer	22.45	22.83	23.60	307.99	289.02	284.02	306.52	285.54	285.16	284.39	na	284.02
DAA-42pz	05/20/19	48	-	1" Piezometer		27.70	30.25	366.57	320.99	315.99	363.99		338.87	336.32	na	315.99
DAA-43pz	05/20/19	15	-	1" Piezometer		dry	dry	309.32	299.00	294.00	309.00		dry	dry	na	294.00
DAA-44pz	05/20/19	45	-	1" Piezometer		36.90	38.70	382.98	339.96	334.96	379.96		346.08	344.28	na	334.96
DAA-45pz	05/20/19	8	-	1" Piezometer		dry	dry	271.24	266.06	261.06	269.06		Dry	Dry	na	261.06
DAA-46pz	05/20/19	35	-	1" Piezometer		26.78	28.80	364.16	330.77	325.77	360.77		337.38	335.36	na	325.77
DAA-47pz	05/21/19	54	-	1" Piezometer		29.27	31.52	360.91	310.19	305.19	359.19		331.64	329.39	na	305.19
DAA-48pz	05/21/19	18	-	1" Piezometer		dry	dry	317.84	302.50	297.50	315.50		Dry	Dry	na	297.50
DAA-101pz	12/01/21	15	15 to 55	2" Piezometer				313.00	265.55	255.55	310.55				296.59	295.55
DAA-112pz	11/29/21	18		2" Piezometer				353.49	343.20	333.20	351.20				347.75	333.20

Not Applicable: Boring/Piezometer outside of the Limits of Disposal Area

* Data provided by Koontz Bryant

TABLE 1A
Groundwater Elevation Data (April 2019 through June 2022)
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

	B-1	B-3	B-7	B-8	B-10	B-12	B-14	B-17	B-18	B-20
Elev-Ground	374.63	347.83	352.33	330.26	341.19	335.89	290.50	381.37	365.42	349.15
Elev-TOC	375.59	348.89	353.71	331.21	342.16	337.01	291.89	383.46	366.17	349.61
Apr-19	338.53	328.99	321.93	295.06	312.44	326.19	261.55	352.08	352.36	314.96
May-19	339.45	329.49	323.18	296.06	312.97	323.93	260.73	353.31	352.23	315.56
Oct-19	338.94	328.83	321.87	296.01	312.06	317.46	258.02	352.47	349.57	314.71
Jan-20	338.08	328.06	321.09	295.36	311.57	317.31	259.43	351.66	349.02	314.76
Mar-20	337.84	327.52	320.83	295.06	311.8	319.16	259.94	351.29	349.72	314.17
Jun-20	337.61	327.04	320.56	295.12	311.78	320.16	259.79	351.01	349.32	313.87
Jul-20	337.41	326.90	320.22	Dry	311.42	318.3	258.68	350.68	348.62	313.52
Aug-20	337.14	326.72	319.97	Dry	311.27	317.52	259.19	350.43	348.27	313.43
Oct-20	336.85	326.48	319.63	Dry	311.1	317.3	259.68	350.18	348.19	313.32
Jan-21	338.40	327.84	321.42	Dry	312.2	325.06	261.05	351.26	351.87	314.10
Mar-21	340.21	329.51	324.18	297.32	313.58	325.06	261.68	353.40	353.70	314.94
Dec-21	339.59	328.40	322.51	296.63	312.25	317.73	258.86	352.66	349.89	314.29
Mar-22	338.89	327.59	321.49	295.76	311.60	318.39	259.52	351.86	349.75	313.81
Jun-22	338.74	326.89	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	351.46	349.65	313.43
MIN	336.85	326.48	319.63	295.06	311.10	317.30	258.02	350.18	348.19	313.32
MAX	340.21	329.51	324.18	297.32	313.58	326.19	261.68	353.40	353.70	315.56
MEAN	338.41	327.88	321.45	295.82	312.00	320.27	259.86	351.70	350.15	314.21
MEDIAN	338	328	321	296	312	318	260	352	350	314
RANGE	3.36	3.03	4.55	2.26	2.48	8.89	3.66	3.22	5.51	2.24
STD	0.94	0.99	1.25	0.73	0.67	3.31	1.07	0.96	1.64	0.67

TABLE 1A
Groundwater Elevation Data (April 2019 through June 2022)
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

	DAA-5pz	DAA-6pz	DAA-8pz	DAA-9pz	DAA-10pz	DAA-11pz	DAA-12pz	DAA-13pz	DAA-14pz	DAA-15pz-s
Elev-Ground	356.49	332.92	364.19	365.25	339.45	335.07	330.07	357.96	380.13	329.98
Elev-TOC	356.50	335.19	365.46	365.68	341.55	336.30	331.20	359.36	381.44	331.15
Apr-19	336.18	316.94	356.99	345.79	318.60	Dry	308.86	334.54	344.65	306.62
May-19	336.94	317.06	355.87	345.97	318.89	312.55	308.85	334.70	345.69	307.07
Oct-19	335.25	313.99	351.91	343.98	316.95	Dry	305.20	332.31	346.14	305.95
Jan-20	334.28	313.24	352.25	343.17	317.20	Dry	Dry	331.43	345.48	305.20
Mar-20	333.90	313.44	353.51	343.56	317.64	Dry	Dry	331.42	345.27	305.50
Jun-20	333.53	313.10	353.31	343.32	317.34	Dry	Dry	331.38	345.06	305.52
Jul-20	333.16	312.41	351.43	342.90	316.65	Dry	Dry	331.01	344.89	305.47
Aug-20	332.92	312.09	351.15	342.58	316.56	Dry	Dry	330.67	344.66	305.30
Oct-20	332.66	311.79	351.33	342.40	316.74	Dry	Dry	330.51	344.39	305.09
Jan-21	334.02	315.34	356.01	345.42	317.94	Dry	Dry	332.99	345.47	307.67
Mar-21	336.71	316.90	355.89	347.13	318.98	312.00	309.13	334.94	347.19	308.82
Dec-21	334.95	313.19	352.60	344.11	317.22	Dry	Dry	331.72	347.46	306.00
Mar-22	334.06	312.53	353.19	343.68	317.30	312.82	305.40	331.16	346.77	305.15
Jun-22	333.49	Not Measured	353.45	343.70	317.22	Not Measured	Not Measured	331.31	346.43	305.81
MIN	332.66	311.79	351.15	342.40	316.56	312.00	305.20	330.51	344.39	305.09
MAX	336.94	317.06	356.99	347.13	318.98	312.82	309.13	334.94	347.46	308.82
MEAN	334.43	314.00	353.49	344.12	317.52	312.46	307.49	332.15	345.68	306.08
MEDIAN	334	313	353	344	317	313	309	331	345	306
RANGE	4.28	5.27	5.84	4.73	2.42	0.82	3.93	4.43	3.07	3.73
STD	1.33	1.84	1.88	1.36	0.77	0.34	1.79	1.47	0.94	1.06

TABLE 1A
Groundwater Elevation Data (April 2019 through June 2022)
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

	DAA-15pz-d	DAA-16pz	DAA-18pz	DAA-19pz-s	DAA-19pz-d	DAA-20pz	DAA-22pz	DAA-23pz-s	DAA-23pz-d	DAA-24pz
Elev-Ground	329.71	323.02	342.12	325.34	325.18	312.39	323.33	318.63	317.94	289.87
Elev-TOC	331.34	324.60	343.46	325.94	327.09	313.62	324.70	320.61	318.67	291.19
Apr-19	306.62	302.92	325.78	308.94	308.92	Dry	287.15	292.02	290.69	268.86
May-19	307.09	297.03	325.2	308.26	308.29	Dry	288.84	294.27	292.41	270.92
Oct-19	306.04	Dry	321.63	305.54	304.89	Dry	289.22	291.41	294.85	270.79
Jan-20	305.39	Dry	321.25	Dry	304.03	Dry	288.63	289.44	288.46	Dry
Mar-20	305.59	Dry	322.19	Dry	304.06	Dry	288.2	288.54	287.77	Dry
Jun-20	305.58	Dry	322.01	Dry	304.09	Dry	287.77	287.98	287.22	Dry
Jul-20	305.56	Dry	320.9	Dry	303.38	Dry	287.36	287.75	287.02	Dry
Aug-20	305.34	Dry	320.68	Dry	303.11	Dry	287.08	287.51	287.02	Dry
Oct-20	305.11	Dry	320.67	Dry	302.78	Dry	286.81	287.25	286.6	Dry
Jan-21	307.69	Dry	324.72	Dry	305.68	Dry	286.85	288.06	287.47	Dry
Mar-21	308.80	Dry	326.44	309.09	308.96	Dry	289.1	293.21	291.62	271.59
Dec-21	306.01	Dry	321.43	Dry	304.7	Dry	290.65	291.19	289.52	267.73
Mar-22	305.24	296.90	321.44	305.39	303.65	Dry	289.82	289.14	289.14	266.69
Jun-22	305.83	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
MIN	305.11	296.90	320.67	305.39	302.78	0.00	286.81	287.25	286.60	266.69
MAX	308.80	302.92	326.44	309.09	308.96	0.00	290.65	294.27	294.85	271.59
MEAN	306.14	298.95	322.64	307.44	305.12	#DIV/0!	288.27	289.83	289.21	269.43
MEDIAN	306	297	322	308	304	#NUM!	288	289	288	270
RANGE	3.69	6.02	5.77	3.70	6.18	0.00	3.84	7.02	8.25	4.90
STD	1.03	2.81	2.01	1.64	2.11	#DIV/0!	1.18	2.24	2.42	1.80

TABLE 1A
Groundwater Elevation Data (April 2019 through June 2022)
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

	DAA-25pz-s	DAA-25pz-d	DAA-26pz	DAA-29pz	DAA-31pz	DAA-34pz	DAA-35pz	DAA-36pz	DAA-40pz	DAA-41pz
Elev-Ground	326.38	326.58	304.20	347.84	348.57	354.70	365.58	340.15	325.93	306.52
Elev-TOC	328.45	327.70	305.08	349.41	349.92	355.38	367.36	340.83	327.50	307.99
Apr-19	304.9	305.82	276.32	328.50	318.28	327.73	335.78	330.58	301.56	285.54
May-19	304.9	305.75	277.01	328.78	318.88	329.47	336.41	330.19	300.67	285.16
Oct-19	302.45	302.65	276.22	323.81	317.72	328.63	335.36	326.79	Dry	284.39
Jan-20	301.23	301.74	276.86	324.75	317.61	327.88	334.65	326.51	Dry	284.84
Mar-20	301.51	302.05	277.43	324.41	317.45	327.55	334.44	327.29	Dry	285.17
Jun-20	301.22	301.75	277.41	324.33	316.88	327.25	334.15	327.09	Dry	284.91
Jul-20	300.7	301.1	276.83	324.06	316.42	327.11	333.91	326.9	Dry	284.48
Aug-20	300.35	300.7	276.93	323.81	316.23	326.88	333.60	325.68	Dry	284.7
Oct-20	300.17	300.45	277.27	323.36	316.04	326.59	333.30	325.62	Dry	285.06
Jan-21	305.13	305.18	278.74	325.87	316.75	327.06	335.33	329.88	Dry	285.99
Mar-21	306.5	307.44	279.79	328.76	318.72	329.53	337.49	331.83	302.33	285.75
Dec-21	302.41	302.77	277.97	325.01	317.79	329.16	336.15	326.91	Dry	284.59
Mar-22	328.45	301.37	278.22	324.01	317.44	328.52	335.46	326.81	297.38	284.93
Jun-22	Not Measured	Not Measured	278.48	324.67	316.88	328.17	335.20	Not Measured	Not Measured	Not Measured
MIN	300.17	300.45	276.22	323.36	316.04	326.59	333.30	325.62	297.38	284.39
MAX	328.45	307.44	279.79	328.78	318.88	329.53	337.49	331.83	302.33	285.99
MEAN	304.61	302.98	277.53	325.30	317.36	327.97	335.09	327.85	300.49	285.04
MEDIAN	302	302	277	325	317	328	335	327	301	285
RANGE	28.28	6.99	3.57	5.42	2.84	2.94	4.19	6.21	4.95	1.60
STD	7.17	2.19	0.96	1.86	0.85	0.94	1.12	1.95	1.89	0.47

TABLE 1A
Groundwater Elevation Data (April 2019 through June 2022)
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

	DAA-42pz	DAA-43pz	DAA-44pz	DAA-45pz	DAA-46pz	DAA-47pz	DAA-48pz	DAA-101pz	DAA-112pz
Elev-Ground	363.99	309.00	379.96	269.06	360.77	359.19	315.50	310.55	351.20
Elev-TOC	366.57	309.32	382.98	271.24	364.16	360.91	317.84	313.00	353.49
Apr-19	Not Installed	Not Installed	Not Installed	Not Installed	Not Installed	Not Installed	Not Installed	Not Installed	Not Installed
May-19	338.87	dry	346.079	Dry	337.38	331.64	Dry	Not Installed	Not Installed
Oct-19	336.32	dry	344.279	Dry	335.36	329.39	Dry	Not Installed	Not Installed
Jan-20	335.32	294.472	343.169	Dry	334.51	328.41	Dry	Not Installed	Not Installed
Mar-20	335.32	294.172	342.579	Dry	333.93	328.97	297.67	Not Installed	Not Installed
Jun-20	335.38	294.392	342.379	261.39	333.78	328.98	297.95	Not Installed	Not Installed
Jul-20	334.90	294.372	341.989	261.32	333.46	328.36	Dry	Not Installed	Not Installed
Aug-20	334.39	Dry	341.629	Dry	333.13	328.04	297.99	Not Installed	Not Installed
Oct-20	334.29	Dry	341.249	Dry	332.78	327.84	298.05	Not Installed	Not Installed
Jan-21	336.48	Dry	342.029	Dry	335.32	330.04	297.95	Not Installed	Not Installed
Mar-21	336.52	Dry	345.189	261.79	338.25	332.43	297.97	Not Installed	Not Installed
Dec-21	336.30	Dry	344.069	Dry	335.71	329.98	298.07	291.32	344.90
Mar-22	335.55	Dry	343.33	Dry	334.74	329.57	298.42	291.67	346.59
Jun-22	335.60	Not Measured	Not Measured	Not Measured	Not Measured	329.75	Not Measured	292.05	Not Measured
MIN	334.29	294.17	341.25	261.32	332.78	327.84	297.67	291.32	344.90
MAX	338.87	294.47	346.08	261.79	338.25	332.43	298.42	292.05	346.59
MEAN	335.79	294.35	343.16	261.50	334.86	329.49	298.00	291.68	345.75
MEDIAN	336	294	343	261	335	329	298	292	346
RANGE	4.58	0.30	4.83	0.47	5.47	4.59	0.76	0.73	1.69
STD	1.13	0.11	1.42	0.21	1.59	1.29	0.19	0.30	0.84

TABLE 2

Precipitation Data

Green Ridge Recycling and Disposal Facility
Cumberland, VA

Month	Monthly Precipitation (inches)	Average Precipitation (inches)
January / 2018	2.67	0.09
February / 2018	2.83	0.10
March / 2018	0.76	0.02
April / 2018	4.94	0.16
May / 2018	6.53	0.21
June / 2018	4.2	0.14
July / 2018	3.03	0.10
August / 2018	4.17	0.13
September / 2018	10.05	0.34
October / 2018	8.01	0.26
November / 2018	6.53	0.22
December / 2018	10	0.32
January / 2019	3.1	0.10
February / 2019	4.09	0.15
March / 2019	3.22	0.10
April / 2019	3.55	0.12
May / 2019		0.00
June / 2019		0.00
July / 2019		0.00

Data obtained from: NOAA Farmville 2 N, VA US USC00442941



APPENDIX HG-2

**PRELIMINARY SUBSURFACE EXPLORATION,
SOIL AND GROUNDWATER STUDY
CUMBERLAND COUNTY, VIRGINIA**

Koontz Bryant Johnson Williams
March 12, 2018



**Preliminary Subsurface Exploration, Soil and
Groundwater Study
Cumberland County, Virginia**

**Client:
CWV LLC
Chesterfield, Virginia**

March 12, 2018



March 12, 2018

CWV LLC

c/o Mr. James H. Martin

Via Email: jamesmartinjr49@gmail.com

RE: Project Completion Report
Cumberland County, Virginia
Project #2017890

Dear Mr. Martin,

Koontz Bryant Johnson Williams PC (KB JW) is pleased to submit this project completion report detailing subsurface exploration of soil and groundwater at the site in Cumberland County. The subject project consists of approximately 8-10 parcels of land totaling 1,100 +/- acres in the eastern portion of the county. A site location map is included as Figure 1.

Field Investigation

Prior to initiation of subsurface exploration, KB JW selected proposed drilling locations based on review of topographic maps for the area. Locations were selected to maximize the area for the proposed land use while minimizing the potential impact from on-site drainages. KB JW personnel then met on-site with a representative from the drilling company to refine the locations based on accessibility.

A total of twenty soil borings were advanced via 3¼ ID hollow stem augers in November and December 2017. Soil samples were collected via Standard Penetration (continuous sampling in the first 10 feet, every 5 feet thereafter) with the exception of boring B-1 which was sampled continuously to establish overall subsurface soil lithology.



Of the twenty borings, ten (B-1, B-2, B-7, B-8, B-10, B-12, B-14, B-17, B-18, B-20) were converted to piezometers to measure static groundwater elevations. Six locations were cored using a wireline core. Of the six locations, five (B-2, B-3, B-6, B-18, B-20) were cored to a total depth of 10 feet below auger refusal. A sixth location (B-13) was attempted however, the core barrel locked up in the rock after one foot of coring. The core barrel was retrieved after an extended recovery period and no further coring was attempted at the location.

Soil and rock core samples were logged during drilling activities. Boring/piezometer logs are attached as Appendix A.

Piezometers were completed using $\frac{3}{4}$ inch ID PVC piping with bell couplings (no glues were used). The piezometers were hand slotted to extend a minimum of 5 feet above where saturated conditions were first encountered. Piezometers were placed through the augers into the natural formation. No sand packs were utilized. End caps were secured on both the bottom and top of the piezometers. Details pertaining to installation of the piezometers is summarized in Table 1 and shown in the attached boring/piezometer logs (Appendix A).

Following completion of the above described field services, KBJW personnel mobilized back to the site to confirm drilling locations and measure the depth to groundwater in readily accessible piezometers.

Laboratory Testing

KBJW performed soils testing on representative samples from multiple locations to confirm lithologies and address soil properties. The results of laboratory testing are shown in Appendix B.

Findings

Based on a review of site topographic conditions, soil boring/piezometer logs, geologic cross-sectional views of the soil/rock conditions, measured groundwater levels, and laboratory testing, the following site conditions were noted.



- Surface topography is rolling with ridges and incised drainages (Figures 1 & 2))
- Surface water flows north towards Muddy Creek (Figures 1 & 2)
- Groundwater mimics surface topography and also flows north towards Muddy Creek (Figure 3)
- Depth to groundwater measured on January 30, 2018 ranged from 19.5 to 39 feet below ground surface (bgs) (Table 1 & Appendix A).
- Overburden soils are generally classified as micaceous fine Sand, SILTY SAND and SILT and range in thickness from 10 feet (B-5) to 55 feet (B-7) (Appendix A).
- Auger refusal was encountered at depths ranging from 10 feet bgs to 55 feet bgs (Table 1 & Appendix A).
- Bedrock generally consisted of biotite rich gneiss (Appendix A).
- Bedrock encountered within ten feet of auger refusal underlying the portion of the site east of Pinegrove Road appeared to be more massive (B-2, B-3, B-6) than that encountered west of Pinegrove Road (B-18 & B-20) (Appendix A).
- Overburden soils generally consist of fine to medium grained Silts (ML) with %passing the #200 sieve values in the average range of 60%. Plasticity Index values typically range from 10-20 and exhibit low to moderate plasticities.

Detailed information regarding soil, bedrock, and groundwater conditions can be found on the boring logs and the attached site maps and profiles.

Sincerely,

Brent E. Johnson P.E., P.G.
Vice President





Figures

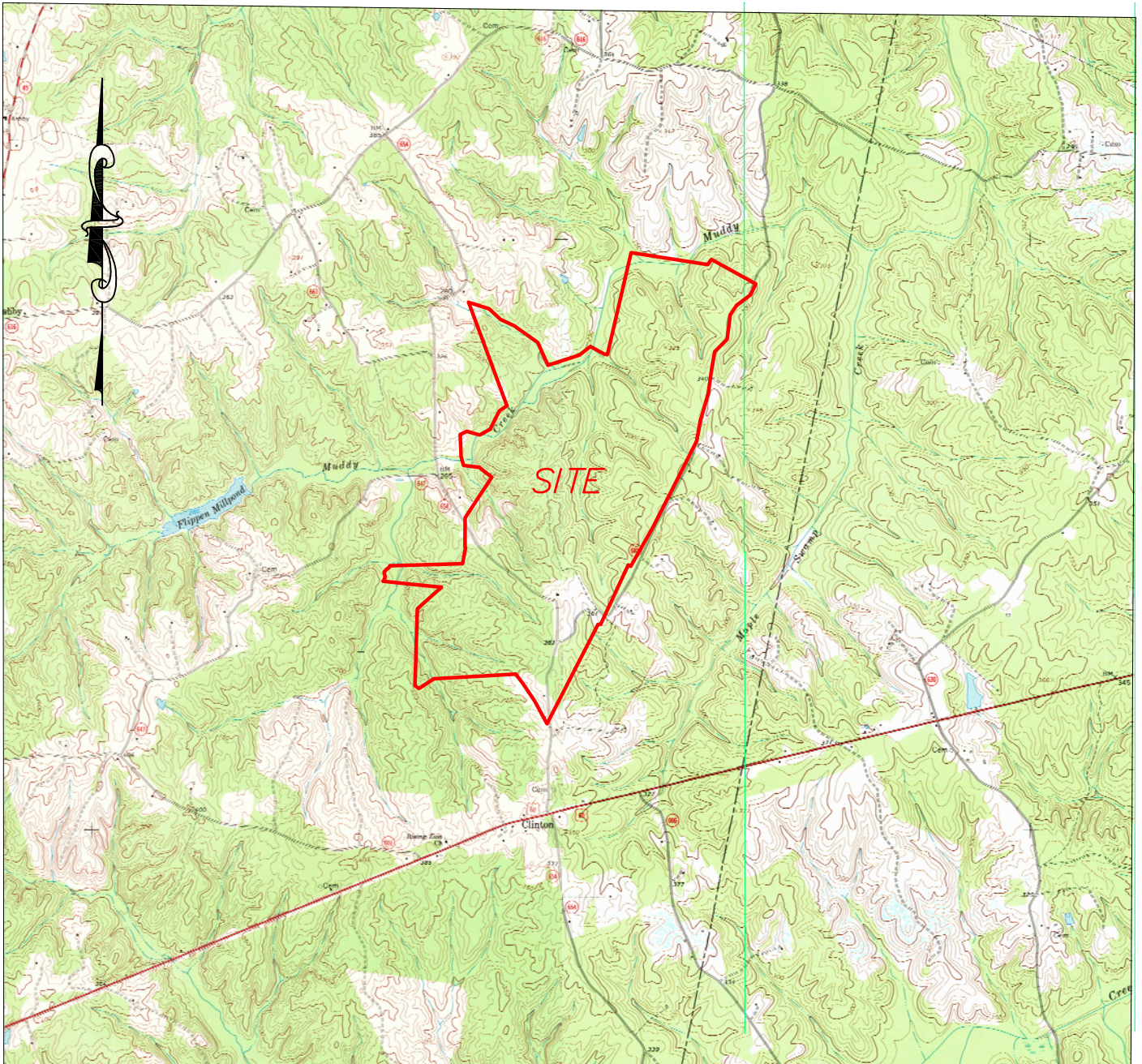
1. Site Location Map
2. Site Base Map
3. Potentiometric Surface Elevation Map
4. Cross-Section A-A'
5. Cross-Section B-B'
6. Cross-Section C-C'
7. Cross-Section D-D'
8. Cross-Section E-E'

Tables

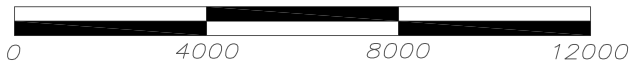
1. Key Elevations

Appendices

- A. Boring/Piezometer Logs
- B. Atterberg Limits



Scale 1: 4000



From USGS 7.5 Minute Quads:
Trenholm, 1969 Photinspected 1979
Whiteville, 1969

FIGURE 1 SITE LOCATION MAP

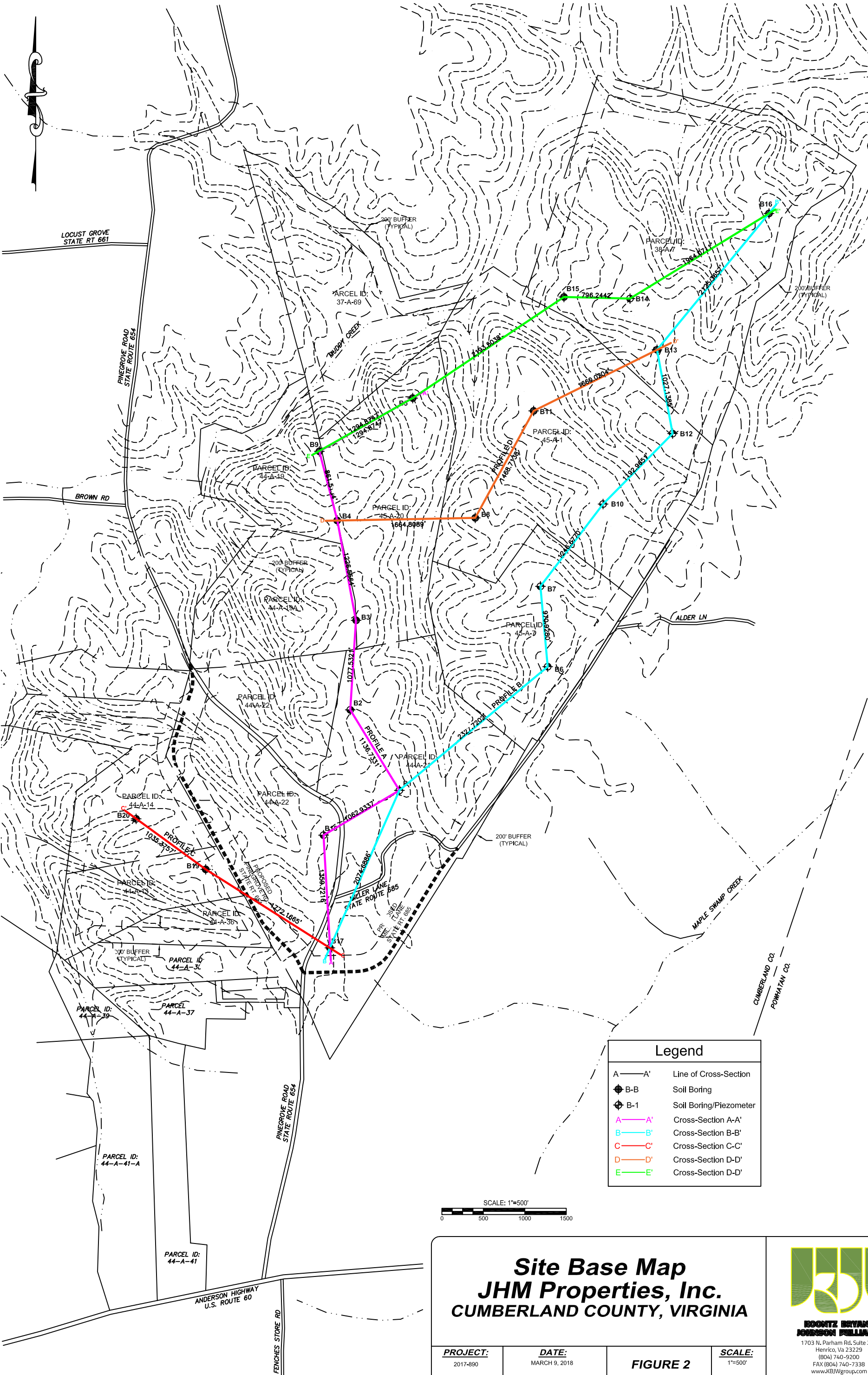
CUMBERLAND, VIRGINIA.

DATE: MARCH 9, 2018

SCALE: 1" = 4000'

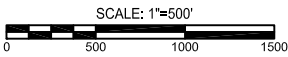


**KOONTZ
BRYANT
JOHNSON
WILLIAMS**



Legend

A — A'	Line of Cross-Section
◆ B-B	Soil Boring
⊕ B-1	Soil Boring/Piezometer
A — A'	Cross-Section A-A'
B — B'	Cross-Section B-B'
C — C'	Cross-Section C-C'
D — D'	Cross-Section D-D'
E — E'	Cross-Section D-D'



Site Base Map
JHM Properties, Inc.
CUMBERLAND COUNTY, VIRGINIA

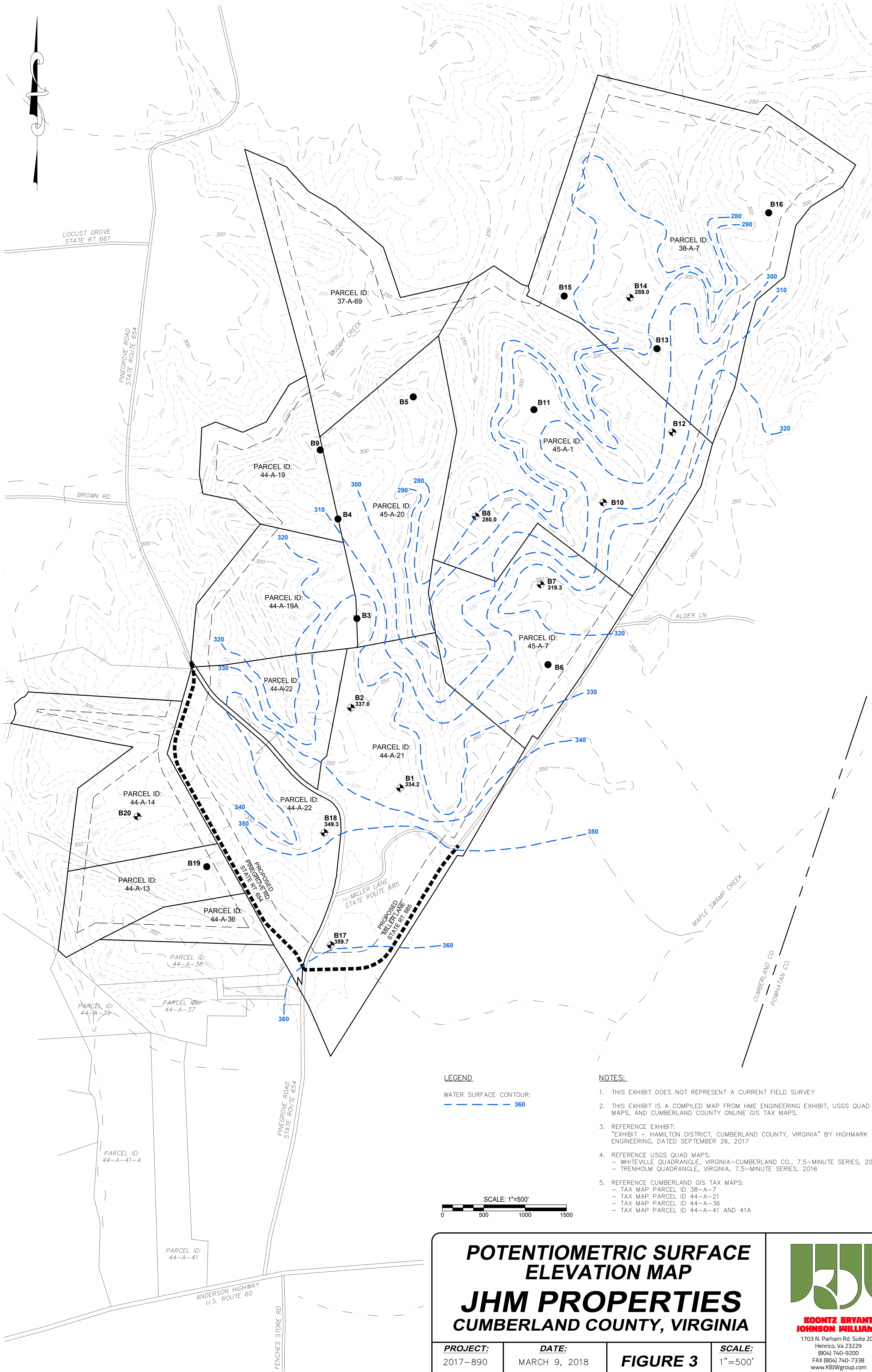
PROJECT:
2017-890

DATE:
MARCH 9, 2018

FIGURE 2

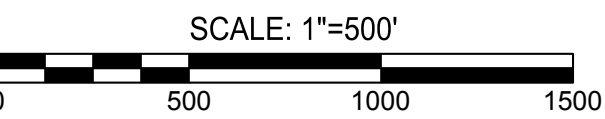
SCALE:
1"=500'

KBCOONTZ BRYANT
JOHNSON PHILLIPS
1703 N. Parham Rd, Suite 202
Henrico, Va 23229
(804) 740-9200
FAX (804) 740-7338
www.KBJWgroup.com



LEGEND

WATER SURFACE CONTOUR:
360



NOTES:

1. THIS EXHIBIT DOES NOT REPRESENT A CURRENT FIELD SURVEY
2. THIS EXHIBIT IS A COMPILED MAP FROM HME ENGINEERING EXHIBIT, USGS QUAD MAPS, AND CUMBERLAND COUNTY ONLINE GIS TAX MAPS.
3. REFERENCE EXHIBIT:
"EXHIBIT - HAMILTON DISTRICT, CUMBERLAND COUNTY, VIRGINIA" BY HIGHMARK ENGINEERING, DATED SEPTEMBER 26, 2017
4. REFERENCE USGS QUAD MAPS:
- WHITEVILLE QUADRANGLE, VIRGINIA-CUMBERLAND CO., 7.5-MINUTE SERIES, 2016
- TRENHOLM QUADRANGLE, VIRGINIA, 7.5-MINUTE SERIES, 2016
5. REFERENCE CUMBERLAND GIS TAX MAPS:
- TAX MAP PARCEL ID 38-A-7
- TAX MAP PARCEL ID 44-A-21
- TAX MAP PARCEL ID 44-A-36
- TAX MAP PARCEL ID 44-A-41 AND 41A

**POTENTIOMETRIC SURFACE
ELEVATION MAP**
JHM PROPERTIES
CUMBERLAND COUNTY, VIRGINIA

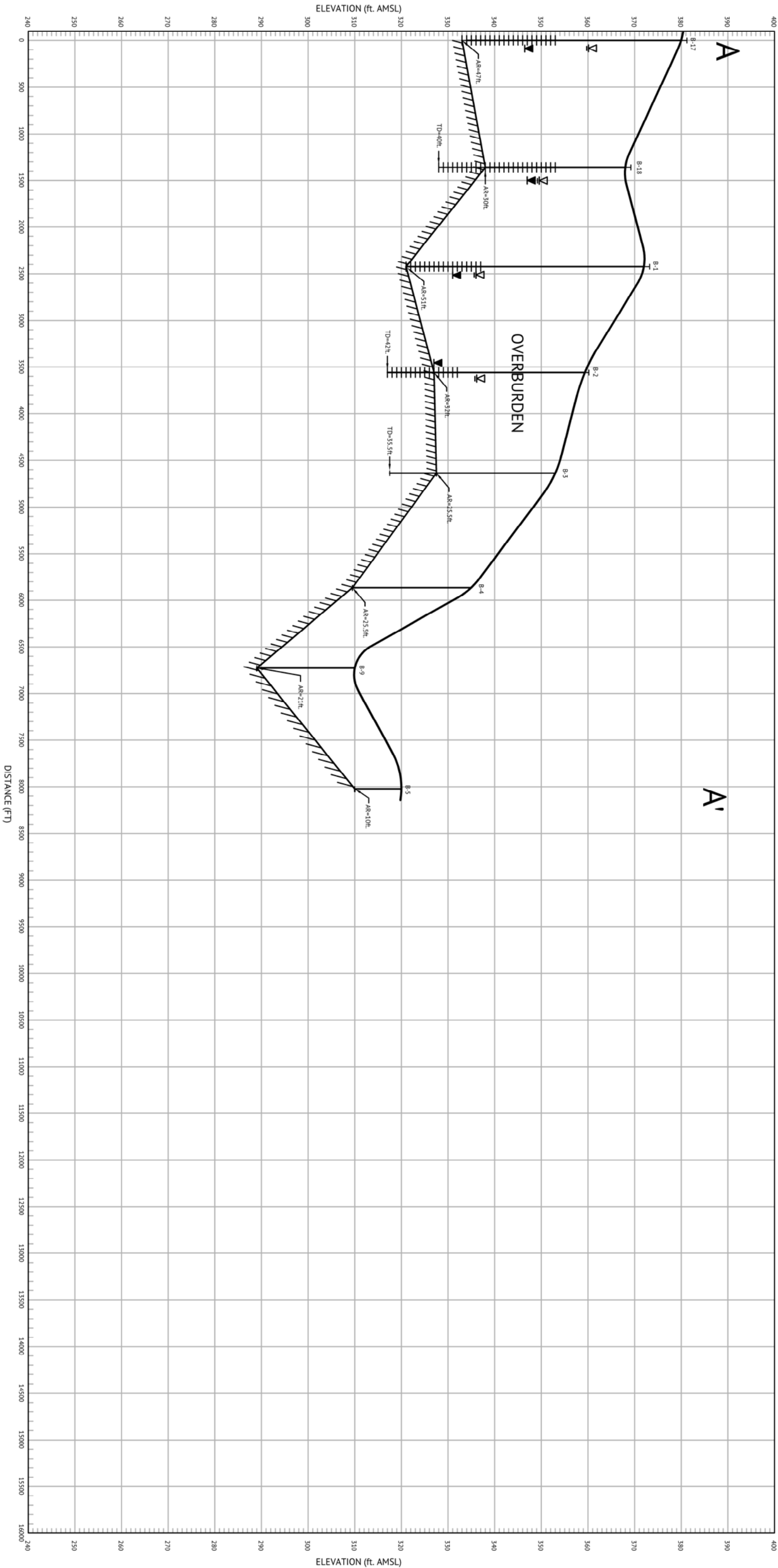
PROJECT:
2017-890

DATE:
MARCH 9, 2018

FIGURE 3

SCALE:
1"=500'





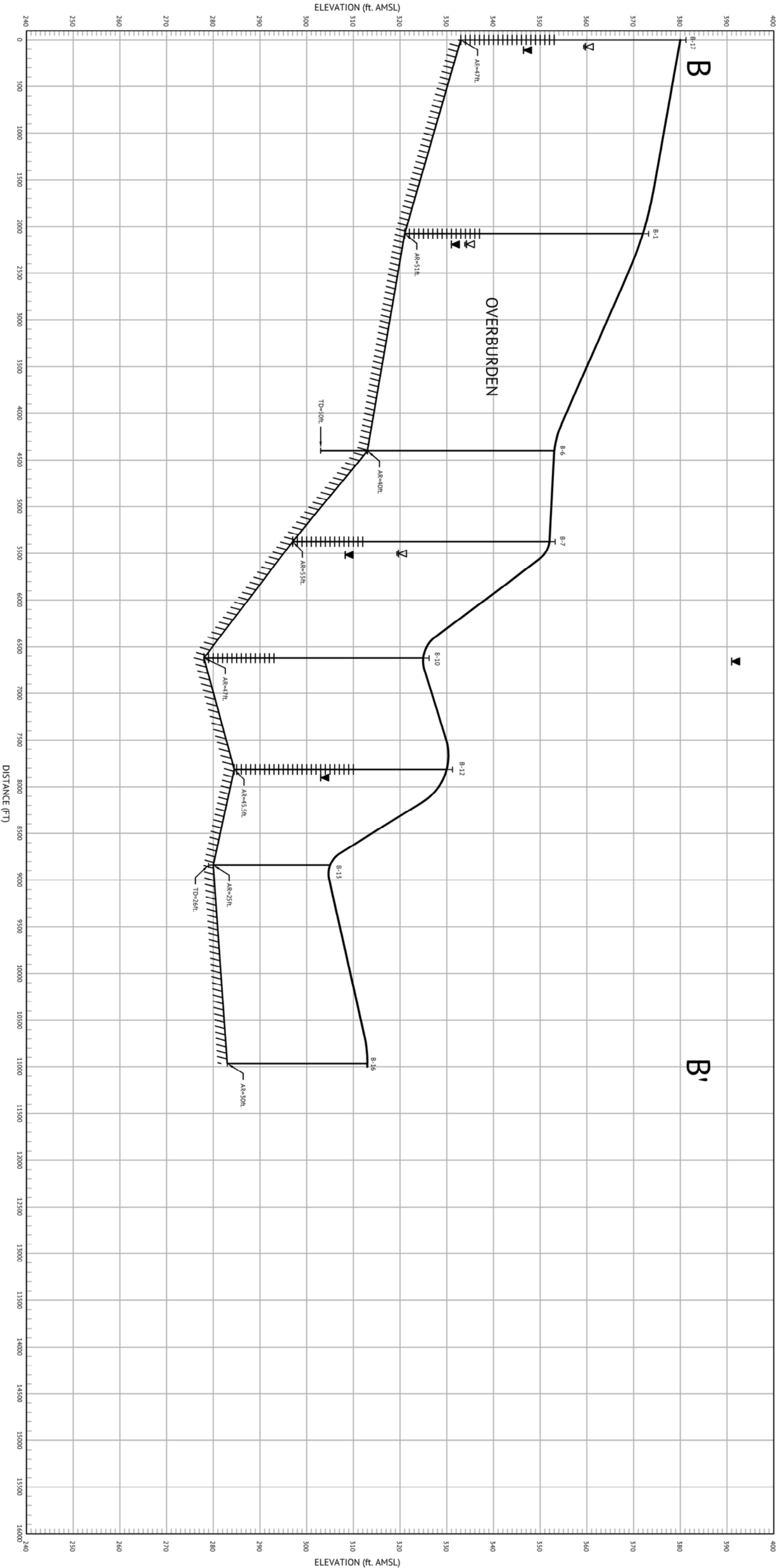
CROSS-SECTION A-A'
JHM PROPERTIES
CUMBERLAND COUNTY, VIRGINIA

PROJECT: 2017-890
DATE: MARCH 8, 2018
FIGURE 4

SCALE: 1"=500'



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GRAPH B
JHM PROPERTIES
CC-1100
KEY BORE HOLE PROPERTIES



CROSS-SECTION B-B'

JHM PROPERTIES


CUMBERLAND COUNTY, VIRGINIA

PROJECT: 2017-890

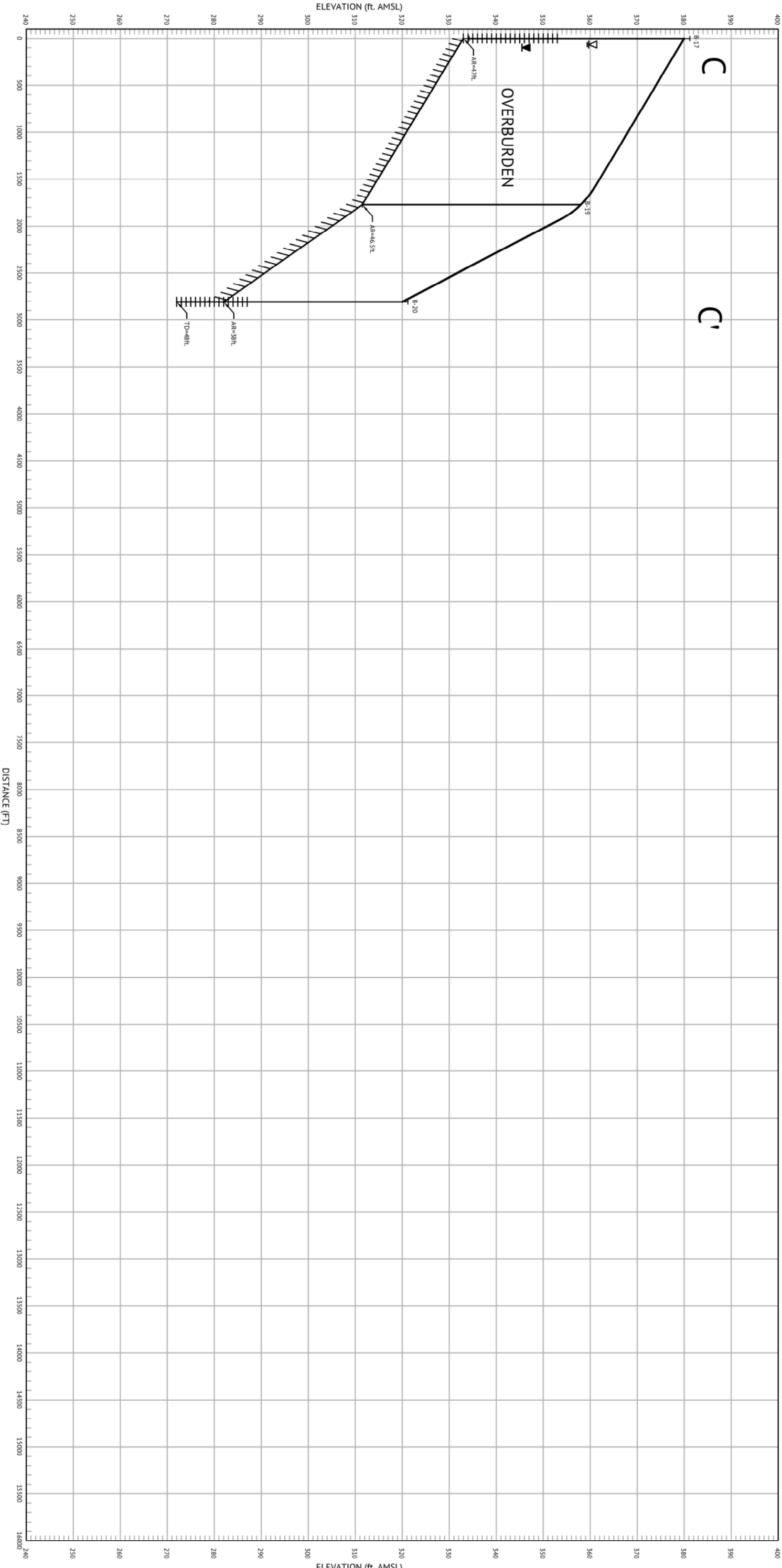
DATE: MARCH 9, 2018

FIGURE 5

SCALE: 1"=500'



ROONTZ BRYANT
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www.RBMJgroup.com



PROJECT:

2017-890

DATE:

MARCH 9, 2018

SCALE:

1"=500'

GRAPH C

JHM PROPERTIES

CUMBERLAND COUNTY, VIRGINIA

ROONTZ BRYANT

JOHNSON WILLIAMS

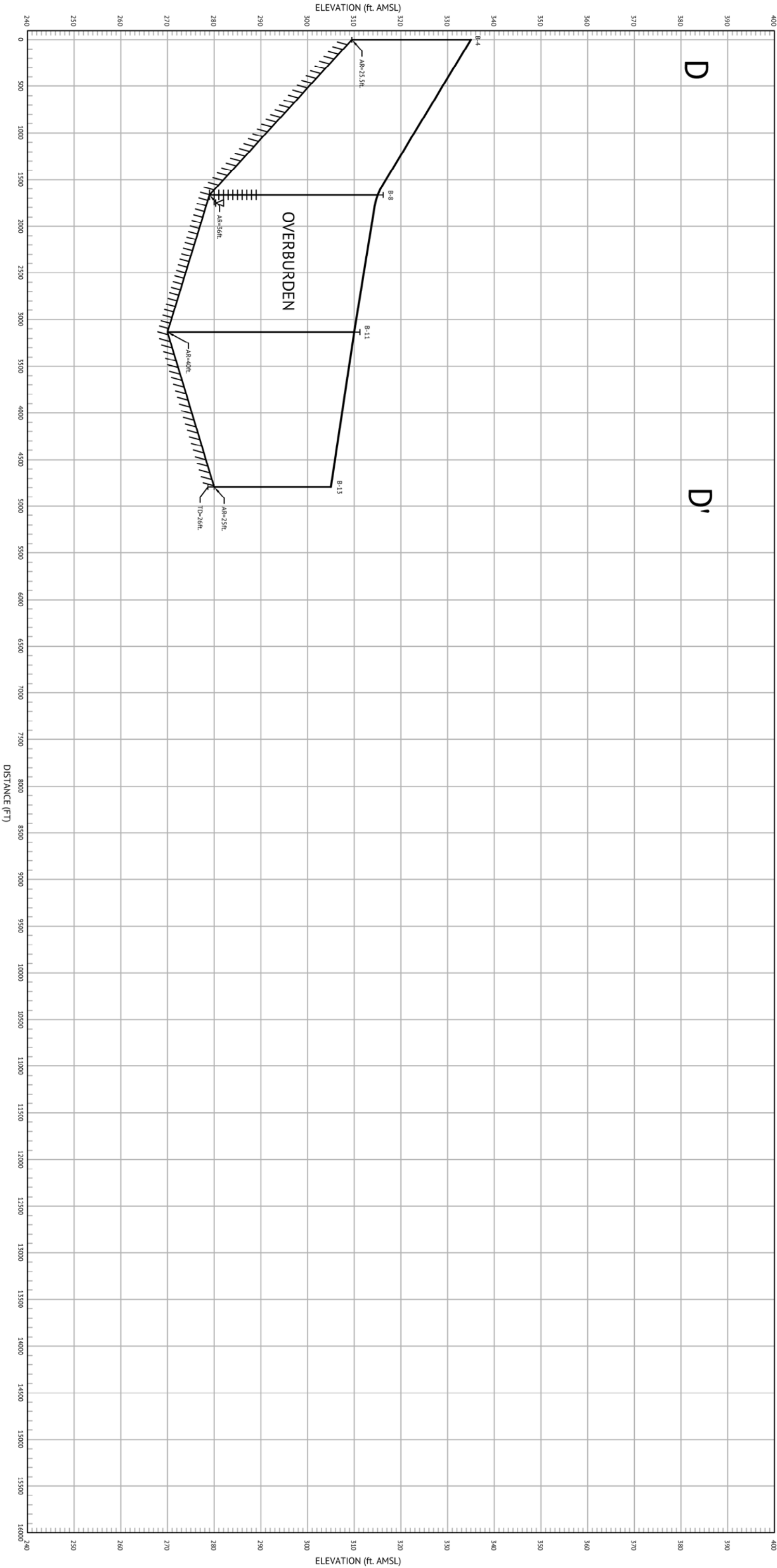
1773 N. Durham Rd. Suite 202

Henrico, VA 23129

(804) 740-9200

FAX (804) 740-7338

www.KJWgroup.com



GRAPH D
JHM PROPERTIES
CC-1100
KEY BORE HOLE PROPERTIES



CROSS-SECTION D-D'

JHM PROPERTIES

CUMBERLAND COUNTY, VIRGINIA

PROJECT:

2017-890

DATE:

MARCH 9, 2018

FIGURE 7

SCALE:

1"=500'

ROOFTZ BRYANT

JOHNSON WILLIAMS

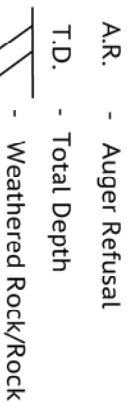
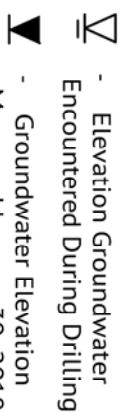
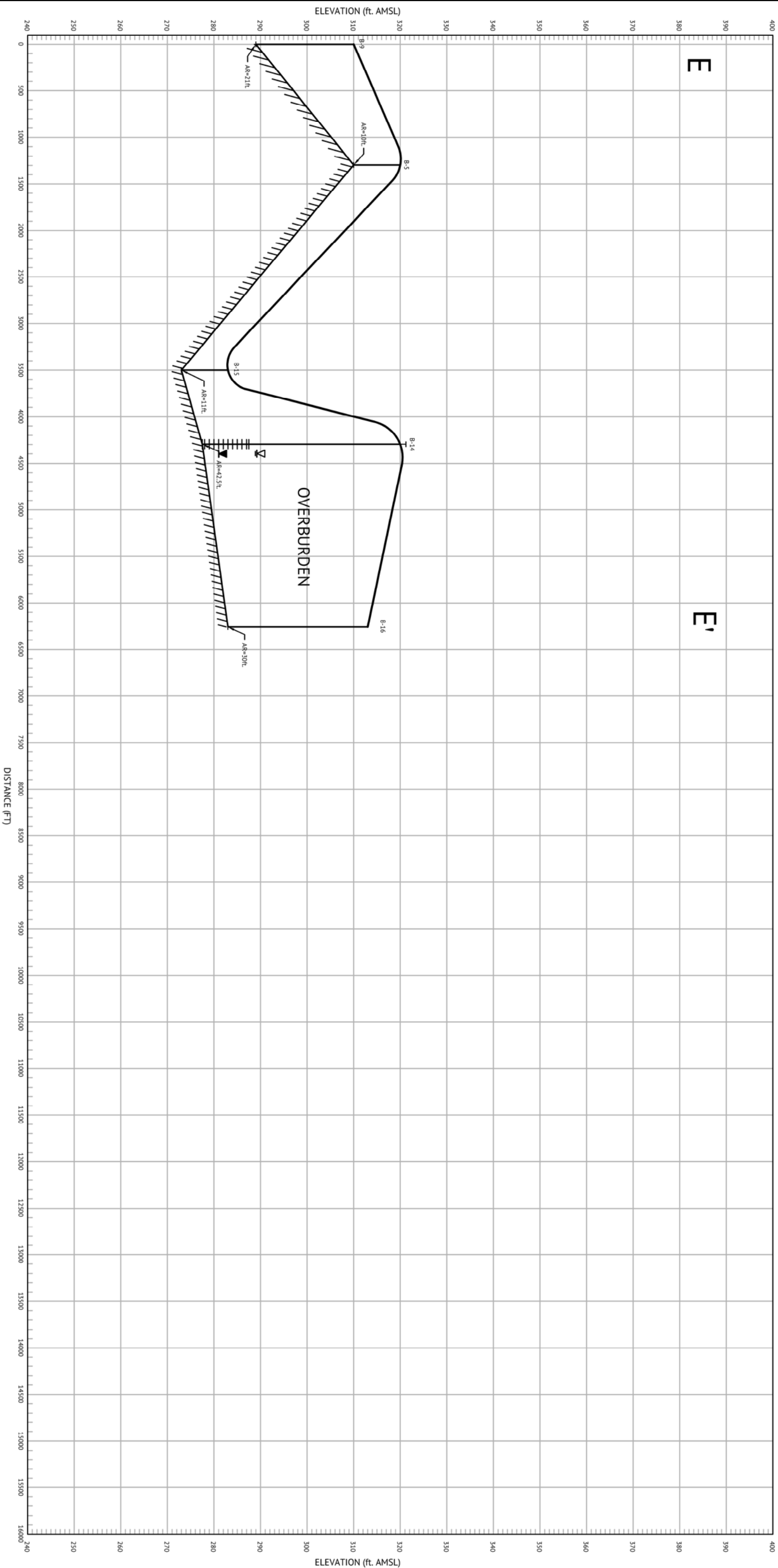
1703 N. Parkham Rd, Suite 202

Henrico, VA 23229

(804) 740-9200

FAX (804) 740-7338

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GRAPH E
JHM PROPERTIES
CC-1100
KEY BORE HOLE PROPERTIES




<p>CROSS-SECTION E-E'</p> <p>JHM PROPERTIES</p> <p>CUMBERLAND COUNTY, VIRGINIA</p>		 <p>ROONTZ BRYANT JOHNSON WILLIAMS</p> <p>1703 N. Parkman Rd. Suite 202 Herricks, VA 23229 (804) 740-9200 FAX (804) 740-7338 www.RJWgroup.com</p>
<p>PROJECT:</p> <p>2017-890</p>	<p>DATE:</p> <p>MARCH 9, 2018</p>	
<p>FIGURE 8</p>		<p>SCALE:</p> <p>1"=500'</p>

TABLE 1
KEY ELEVATIONS
CWV LLC
CUMBERLAND COUNTY, VA

LOCATION	GRD. ELEV. (ft. AMSL)	STICKUP ft.	TOC ELEV. (ft. AMSL)	INITIAL GW ELEV. (ft. AMSL)	DEPTH TO GW. ft.	ELEV. GW. (ft. AMSL)	DEPTH TO REFUSAL/RX ft.	REFUSAL/ TOP OF ROCK (ft. AMSL)	TOP OF SCREEN ELEV. (ft. AMSL)	BOTTOM OF SCREEN ELEV. (ft. AMSL)	TD (ft. AMSL)	COMMENTS
B-1	372.0	1.2	373.2	331.0	39.0	334.2	51.0	321.0	337.0	321.0	---	Stopped at auger refusal
B-2	359.0	1.0	360.0	327.0	23.0	337.0	32.0	327.0	332.0	317.0	317.0	Cored 10 ft. below auger refusal
B-3	353.0	---	---	---	---	---	25.5	327.5	---	---	317.5	Cored 10 ft. below auger refusal
B-4	335.0	---	---	---	---	---	25.5	309.5	---	---	---	Stopped at auger refusal
B-5	320.0	---	---	---	---	---	10.0	310.0	---	---	---	Stopped at auger refusal
B-6	353.0	---	---	---	---	---	40.0	313.0	---	---	303.0	Cored 10 ft. below auger refusal
B-7	352.0	1.3	353.3	308.5	34.0	319.3	55.0	297.0	312.0	297.0	---	Stopped at auger refusal
B-8	315.0	1.0	316.0	---	36.0	280.0	36.0	279.0	289.0	279.0	---	Stopped at auger refusal
B-9	310.0	---	---	---	---	---	21.0	289.0	---	---	---	Stopped at auger refusal
B-10	325.0	1.0	326.0	291.0	Dry	Dry	47.0	278.0	293.0	278.0	---	Stopped at auger refusal
B-11	310.0	---	---	---	---	---	40.0	270.0	---	---	---	Stopped at auger refusal
B-12	330.0	1.2	331.2	303.0	NM	NM	45.5	284.5	310.0	284.5	---	Stopped at auger refusal
B-13	305.0	---	---	---	---	---	25.0	280.0	---	---	279.0	Cored 1 ft. below auger refusal
B-14	320.0	1.5	321.5	281.0	32.5	289.0	42.5	277.5	287.5	277.5	---	Stopped at auger refusal
B-15	283.0	---	---	---	---	---	11.0	272.0	---	---	---	Stopped at auger refusal
B-16	313.0	---	---	---	---	---	30.0	283.0	---	---	---	Stopped at auger refusal
B-17	380.0	2.2	382.2	346.5	22.5	359.7	47.0	333.0	353.0	333.0	---	Stopped at auger refusal
B-18	368.0	0.8	368.8	347.0	19.5	349.3	30.0	338.0	353.0	328.0	328.0	Cored 10 ft. below auger refusal
B-19	358.0	---	---	---	---	---	46.5	311.5	---	---	---	Stopped at auger refusal
B-20	320.0	0.6	320.6	---	NM	NM	38.0	282.0	287.0	272.0	272.0	Cored 10 ft. below auger refusal

NOTES: GRD. ELEV. - Ground Elevation
TOC ELEV. - Top of Casing Elevation
INITIAL GW. ELEV. - Initial Groundwater Elevation; encountered during drilling of boring
DEPTH TO GW. - Depth to Groundwater; measured 1-30-18 from TOC
ELEV. GW. - Elevation Groundwater; measured 1-30-18 from TOC
DEPTH TO REFUSAL/RX - Depth to Auger Refusal/Rock
TOP OF SCREEN ELEV. - Top of Screen Elevation
BOTTOM OF SCREEN ELEV. - Bottom of Screen Elevation
TD - Total Depth
ft. AMSL - Feet Above Mean Sea Level
ft. - Feet
NM - Not measured; unable to remove caps
B-14; core barrel got stuck at 1 ft. below auger refusal; barrel was retrieved after several hours, no further rock coring performed at this location



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.2 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-1		G S Technician: J. Patterson				
Date: 11/29-30/2017	Depth: 51.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
2	Red brown sandy SILT, trace organic matter, moist	3		372.0		Push Cap
		3				
		4				
		5				
4		5				
		8				
		10				
		12				
6		5				
		8				
		9				
		10				
8	Red brown SILT with sand, trace rock fragments @10 ft., moist	5				
		6				
		7				
		7				
10		3				
		5				
		6				
		5				
12		4				
		3				
		4				
		5				
14		6				
		4				
		3				
		3				
16	White gray pink very fine SAND, dry (saprolitic structure)	4				
		2				
		3				
		3				
18		4				
		4				
		3				
		4				
20		4				
		4				
		5				
20		5				Natural Formation



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-1		G S Technician: J. Patterson				
Date: 11/29-30/2017	Depth: 51.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
22	Light brown very fine SAND, dry	4		337.0		
		7				
		7				
		8				
24	White black micaceous very fine SAND, trace rock fragments, dry (increasing structure with depth)	7				
		8				
		6				
		5				
26	Light brown light gray micaceous SILTY SAND (saprolitic structure at base)	6				
		7				
		6				
		6				
28		3				
		4				
		4				
		5				
30	Light brown brown SILTY SAND, moist	5				
		5				
		5				
		7				
32	Light gray very fine SAND, dry	3				
		11				
		15				
		15				
34	Light gray very fine SAND, trace rock fragments @ 32.5 ft., dry	9				
		14				
	Red pink black weathered granite, dry	13				
		14				
36	Gray dark gray, some white banding, very fine SAND, dry	14				
		17				
		17				
		18				
38	Dark gray black micaceous very fine SAND, dry, biotite rich granodiorite residuum (36.5-37 ft.)	23				
		28				
		50/6				
		50/3				
40	Dark gray black micaceous very fine SAND, dry					

337.0

1.25" ID Push Coupling PVC Pipe

Natural Formation

Hand Slotted Screen
1.25" ID PVC Pipe



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-1		G S Technician: J. Patterson				
Date: 11/29-30/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3	Saturated @ 41 ft.	331.0		
42						
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3				
44						
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3				
46						
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3				
48						
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3				
50						
	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3				
51	Dark gray black micaceous very fine SAND, trace rock fragments, dry	50/3	Auger Refusal @ 51.0 ft.	321.0		



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.0 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-2		G S Technician: J. Patterson				
Date: 11/30/2017	Depth: 42.0 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
				359.0		
2						
		3				
	Red brown SILT, trace clay, moist	5				
		7				
4		8				
	Red brown SILT, trace clay, moist	5				
	Red brown SILT, dry	6				
		7				
6	Light brown SILT, trace organic matter at base, dry	7				
	Light brown SILT, trace structure at base, dry	4				
		4				
		5				
8		4				
	Yellow brown SILT, trace rock fragments, dry	4				
		3				
		3				
10		2				
12						
14	Yellow brown SANDY SILT, some quartz fragments, moist	3				
		4				
		6				
16						
18						
	Yellow brown SILT, some quartz fragments, dry	15				
	White light gray fine to medium	11				
20	SAND with structure, dry	9				

Push Cap

1.25 " ID Push Coupling PVC Pipe

Natural Formation

Push Cap


1.25 " ID Push Coupling PVC Pipe

Natural Formation



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-2		G S Technician: J. Patterson				
Date: 11/30/2017	Depth: 42.0 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
22						
24	Black white felspathic granodiorite residuum, dry	23				
	Yellow brown light gray fine to coarse SAND, some rock fragments, dry	32				
		50/5				
26						
28						
	Dark gray gray white brown fine SAND, trace rock fragments, dry	50/3				
30						
32			Saturated at 32 ft. Auger Refusal @ 32 ft.	332.0		1.25 " ID Push Coupling PVC Pipe
34						
36	Biotite rich gneiss with felspathic banding		Run 1: 32-37 ft. Recovery - 38/60 Inches = 63% RQD = 22.75/38 Inches = 60%			Natural Formation
38			Run 2: 37-42 ft. Recovery - 60/60 inches = 100% RQD = 59/60 inches = 98%	327.0		Rock
40						Hand Slotted Screen 1.25" ID PVC Pipe



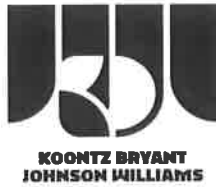
Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-2		G S Technician: J. Patterson				
Date: 11/30/2017	Depth: 42.0 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
	Blotite rich gneiss with felspathic banding		Run 2 - 37-42 ft. Recovery - 60/60 inches = 100% RQD = 59/50 inches = 98%			
42					317.0	

Total Depth @ 42 ft.

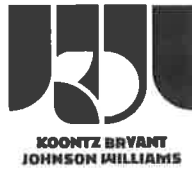


**KOONTZ BRYANT
JOHNSON WILLIAMS**

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-3		G S Technician: J. Patterson		
Date: 11/30-12/1/17	Depth: 35.5 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core		
Depth	Soil/Rock Description	Blow Count	Remarks	353.0
2				
	Light brown red brown CLAYEY SILT, moist, organic matter at top, rock fragments at 3 ft.	4		
		6		
		7		
4		10		
	Light brown red brown CLAYEY SILT, moist	4		
		7		
	Light brown red brown SILT, trace rock fragments at 6 ft., dry	6		
6		10		
		4		
	Dark brown biotite rich SILT, dry	5		
		7		
8				
	Red brown SILT, structure at base, dry	6		
		6		
		5		
10		7		
12				
14	Biotite rich very fine SAND, trace muscovite, with structure, dry	10		
		13		
		11		
16				
18				
		50/3		
20				



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	
Client: J. H. Martin		Driller: P. Smith			
Location: B-3		G S Technician: J. Patterson			
Date: 11/30-12/1/17	Depth: 35.5 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core			
Depth	Soil/Rock Description	Blow Count	Remarks		
22	Biotite rich very fine SAND, trace muscovite, with structure, dry			327.5	
24					
26					
26	25.5-26.7 ft. - Banded granodiorite gneiss	50/2	Auger Refusal @ 25.5 ft.		
28	26.7--27 ft. - Quartz rich granodiorite 27-27.9 ft.-Granodiorite, two parallel vertical fractures		Run 1 - 25.5-30.5 ft. Recovery - 60/60 inches = 100% RQD = 51.5/60 inches = 86%		
30	27.9-30.5 ft. - Granodiorite gneiss		Rock		
32	Biotite rich granodiorite gneiss, dry, vertical fracture @ 32.5-32.7 ft.				Run 2 - 30.5-35.5 ft. Recovery - 60/60 inches = 100% RQD = 47.5/60inches = 79%
34					
					317.5



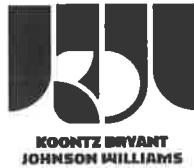
Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-4		G S Technician: J. Patterson		
Date: 12/1/2017	Depth: 25.5 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	335.0
2				
	Light brown very fine SAND, dry	14		
		35		
4	White light brown very fine SAND, with structure, dry	43		
		36		
	White light brown very SILTY SAND with structure, dry	18		
		25		
6	Biotite rich weathered granodiorite, dry	28		
		47		
	Light brown dark brown very fine SAND, some structure, dry	25		
		50/5		
8				
	Light brown brown white very fine SAND, some structure, dry	50/5		
10				
12				
14	Light brown very fine SAND with structure, dry	22		
		25		
	Red brown dark gray very fine SAND, trace quartz fragments, dry	28		
16				
18				
	Light gray light brown fine to medium SAND with horizontal structure, trace rock fragments, dry	50/3		
20				



KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-4		G S Technician: J. Patterson		
Date: 12/1/2017	Depth: 25.5 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	
22				309.5
24	Light gray light brown micaceous fine to medium	50/6		
	SAND, dry			

Auger Refusal @ 25.5 ft.



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-5		G S Technician: J. Patterson		
Date: 12/4/2017	Depth: 10 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	320.0
2				
	Light brown light gray SILT, dry	13 50/6		
4				
	Light brown light gray very fine SANDY SILT, dry biotite rich from 4-4.5 ft.	17 50/5		
6				
	Gray brown very fine SILT, dry	33 50/3		
8				
	No Return	50/0		
10				

Auger Refusal @ 10 ft.

310.0



KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-6		G S Technician: J. Patterson		
Date: 12/12/2017	Depth: 50 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core		
Depth	Soil/Rock Description	Blow Count	Remarks	353.0
2				
	Red micaceous CLAYEY SILT, moist	2		
		4		
		4		
4		5		
	Red micaceous SILT, trace quartz fragments at top of sample, moist to dry	3		
		3		
		3		
6		4		
	Dark brown light brown micaceous SILT, dry	3		
		3		
		3		
8		3		
	Light brown light gray micaceous SILT, trace quartz fragments, dry	2		
		3		
		3		
10		3		
12				
14		4		
	Light gray light brown micaceous SILT, dry	6		
		7		
16				
18				
	Light gray light brown micaceousSANDY SILT, dry	6		
		11		
20		17		

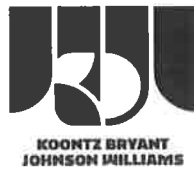


KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-6		G S Technician: J. Patterson		
Date: 12/12/2017	Depth: 50 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core		
Depth	Soil/Rock Description	Blow Count	Remarks	
22				
24	Light gray light brown SANDY SILT, weathered granite at base, dry	29 50/5		
26				
28				
	Light gray light brown micaceous SANDY SILT with quartz fragments, dry	50/2		
30				
32				
34		NR		
36				
38				
40		NR		

Auger Refusal @ 40 ft.

313.0

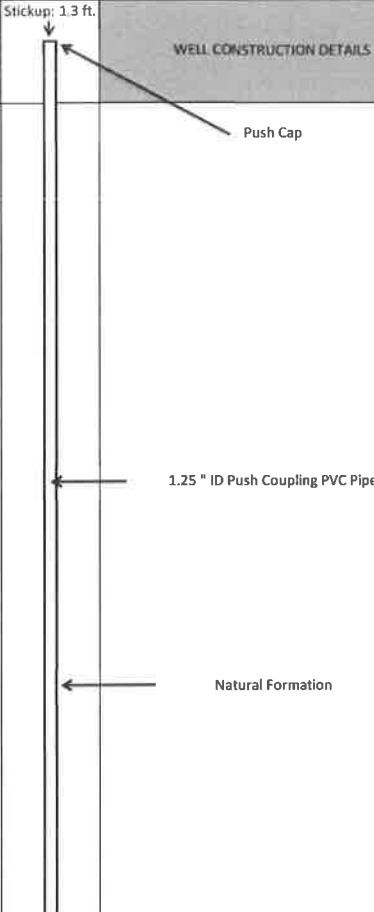


Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-6		G S Technician: J. Patterson		
Date: 12/12/2017		Depth: 50 ft.		
Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks	
	Biotite rich banded GNEISS with quartz, dry		Run 1 - 40-45 ft. Recovery - 52/60 inches = 87% RQD = 44/60 inches = 73%	
42	Massive quartz intrusion, dry			
44				
	Highly weathered biotite rich SCHIST, dry		Rock	
46	Highly weathered SCHIST, dry		Run 2 - 45-50 ft. Recovery - 52/60 inches = 87% RQD = 35.5/60 inches = 59%	
	Weathered biotite rich GNEISS with quartz, dry			
48	Biotite rich GNEISS with quartz banding, pyrite noted throughout, dry			
50				

303.0

Total Depth @ 50 ft.



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.3 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-7		G S Technician: J. Patterson				
Date: 12/4-5/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks	352.0		
2						
4	Red brown micaceous SILT, moist	5 4 6 8				
6	Red brown SILT trace quartz fragments, dry	5 5 7 8				
8	Light brown SILT, trace structure, dry	5 6 4				
	Light brown white very fine SANDY SILT, dry	3				
	Light brown light gray SANDY SILT, dry	3 6 7				
10		4				
12						
14	Light gray white very fine SANDY SILT, dry	4 5				
	Light gray light brown fine to medium SAND, dry	5				
16						
18						
20	Light gray white very fine SANDY SILT, dry	7 11 10				

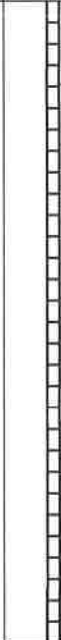


Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith			
Location: B-7		G S Technician: J. Patterson			
Date: 12/4-5/2017		Boring Method: 3.25" ID H. S. Auger			
Depth	Soil/Rock Description	Blow Count	Remarks		
22					
24		7			
	Light brown light gray micaceous very fine SANDY SILT, trace rock fragments at top, dry	12			
		14			
26					
28					
	Light brown red black micaceous very fine SANDY SILT, dry	9			
	White light gray very fine SANDY	31			
30	SILT with rock fragments, dry	25			
32					
34		20			
	White light brown micaceous SANDY SILT, dry	12			
		23			
36					
38					
		21			
	Light brown white light gray black micaceous very fine SANDY SILT, dry	36			
40		50/3			

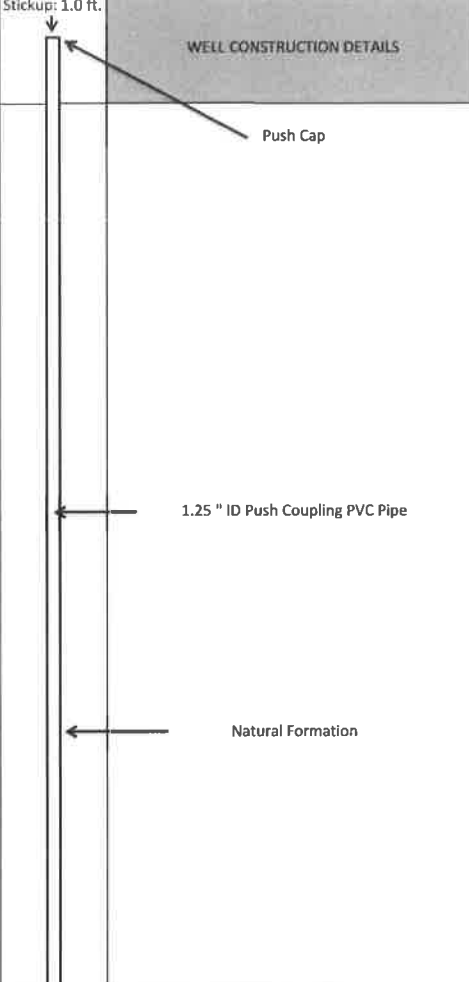
1.25" ID Push Coupling PVC Pipe

Natural Formation

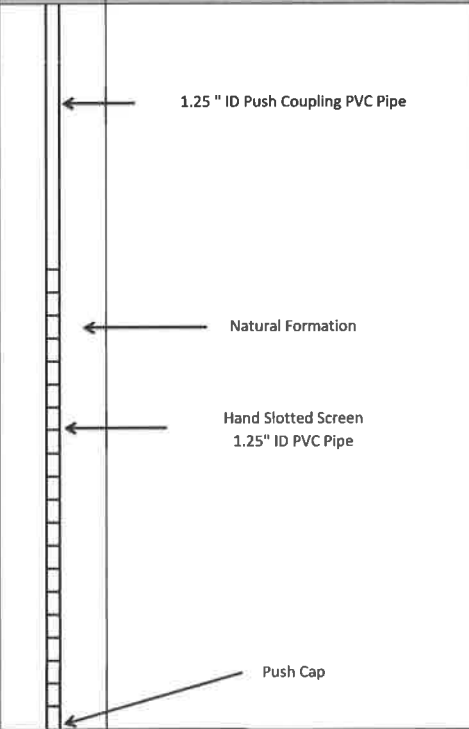


Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	WELL CONSTRUCTION DETAILS		
Client: J. H. Martin		Driller: P. Smith					
Location: B-7		G S Technician: J. Patterson					
Date: 12/4-5/2017	Depth: 55 ft.	Boring Method: 3.25" ID H. S. Auger					
Depth	Soil/Rock Description	Blow Count	Remarks				
42			Saturated @ 43.5 ft.	312.0			
44	Light brown light gray very fine SANDY SILT with rock fragments at the top, saturated	50/5		308.5			
46							
48							
50	Light brown light gray biotite rich very fine SANDY SILT, saturated	50/6					
52							
54	No Return, saturated spoon	50/0					
55							
Auger Refusal @ 55 ft.				297.0			



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.0 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-8		GS Technician: J. Patterson				
Date: 12/4/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks	315.0		 <p>Push Cap</p> <p>1.25" ID Push Coupling PVC Pipe</p> <p>Natural Formation</p>
2						
	Brown light brown SILT, some CLAYEY	3				
	SILT from 2.3-2.7 ft., moist to dry	4				
4		4				
		8				
	Red brown light brown SILT with biotite	8				
	banding, trace quartz rock fragments, dry	9				
6		16				
		15				
		9				
	Light brown SILT, trace quartz fragments,	11				
8	dry	10				
		13				
	Light brown SANDY SILT with micaceous	19				
	banding, dry	18				
10		13				
		16				
12						
14	Light brown SILT with micaceous banding,	8				
	dry	12				
	Yellow brown white very fine SAND, dry	50/3				
16						
18						
	Light brown brown micaceous SILT, trace	13				
	quartz fragments, structure, dry	18				
20		17				



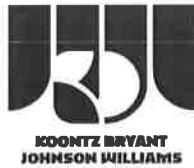
Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS			
Client: J. H. Martin		Driller: P. Smith							
Location: B-8		G S Technician: J. Patterson							
Date: 12/4/2017	Depth: 36 ft.	Boring Method: 3.25" ID H. S. Auger							
Depth	Soil/Rock Description	Blow Count	Remarks						
22				289.0					
24	Light brown very fine SANDY SILT, dry	50/6							
26									
28									
30	Light brown white fine to medium SAND, some quartz fragments, dry	50/5							
32									
34	No Return	50/1							
36									
Auger Refusal @ 36 ft.							279.0		

Auger Refusal @ 36 ft.



**KOONTZ BRYANT
JOHNSON WILLIAMS**

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-9		G S Technician: J. Patterson		
Date: 12/1/2017	Depth: 21 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	310.0
2				
	Light brown dark brown micaceous SANDY SILT, moist	3		
		7		
4		7		
	Brown dark brown SILT with horizontal structure, moist	16		
		27		
6		50/2		
	White light gray light brown black very fine SAND, dry	30		
		50/5		
8				
	Light gray light brown black fine SANDY SILT with structure, dry	44		
		50/2		
10				
12				
14	Light gray light brown black fine SANDY SILT with structure, dry	14		
		9		
		20		
16				
18				
	Light brown light gray fine SANDY SILT, dry	50/3		
20				




Project: CC-1100			Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin			Driller: P. Smith		
Location: B-9			G S Technician: J. Patterson		
Date: 12/1/2017		Depth: 21 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description		Blow Count	Remarks	
21					289.0

Auger Refusal @ 21 ft.

289.0



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.0 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-10		G S Technician: J. Patterson				
Date: 12/5/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks	325.0		Push Cap
2						
		11				
	light brown light gray very fine SANDY	12				
	SILT, trace rock fragments & structure at	15				
4	base, dry	14				
		20				
	Light brown light gray SILT with horizontal	26				
	structure, dry	15				
6		14				
	Light gray light brown very fine SANDY	10				
	SILT, dry	11				
	Light gray light brown micaceous SILT with	12				
8	and, some structure, dry	16				
	Light gray light brown very fine SANDY	28				
	SILT, dry	50/5				
10						
12						
14	Black white light brown weathered	13				
	granodiorite with gneissic banding, dry	17				
	White light gray very fine SANDY SILT with	19				
	structure, dry					
16						
18						
	White light gray very fine SANDY SILT with	6				
	structure, dry	8				
20	Light brown micaceous Silt, dry	11				



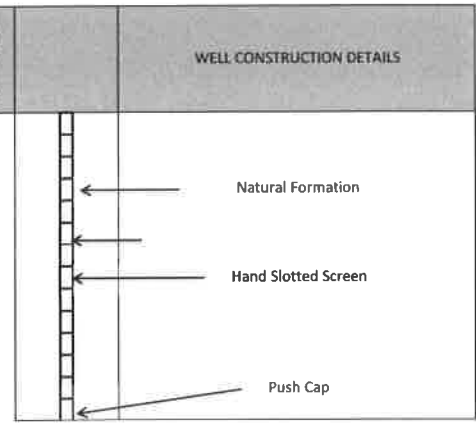
Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-10		G S Technician: J. Patterson				
Date: 12/5/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
22			Saturated @ 34 ft.	293.0		
24		13				
	Ught brown white micaceous SILT, dry	16				
		28				
26						
28						
	Light brown light gray white micaceous SILT with plagioclase feldspar from 28.6-28.7 ft., with structure dry	30				
30		50/6				
32						
34	Black white micaceous SILT, moist to saturated @ 34 ft.	50/6				
36						
38						
	Dark brown brown gray black micaceous SILT with banding, saturated	20				
40		48				
		50/4				



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT. - AMSL)	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith			
Location: B-10		G S Technician: J. Patterson			
Date: 12/5/2017	Depth: 47 ft.	Boring Method: 3.25" ID H. S. Auger			
Depth	Soil/Rock Description	Blow Count	Remarks		
42					
44	Dark gray gray light green black micaceous SILT, saturated	50/6			
46					
47				278.0	

Auger Refusal @ 47 ft.

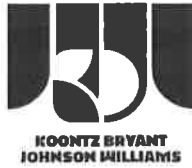
278.0





KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-11		G S Technician: J. Patterson		
Date: 12/5/2017	Depth: 40 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	310.0
2				
		3		
		5		
4	Light brown micaceous SILT, moist	5		
		7		
		5		
		7		
		11		
6	Yellow brown very fine SANDY SILT, dry	11		
	Light brown white SILT, dry	42		
	Light gray white fine SAND with quartz fragments, dry	46		
8	Brown light brown red brown black weathered granodiorite, dry	20		
		12		
		13		
		14		
10	Light brown red brown SILT, dry	14		
		14		
12				
14	Light gray light brown yellow brown micaceous very fine SANDY SILT, structure increasing with depth, dry	10		
		12		
		12		
16				
18				
	Light brown light gray black weathered granodiorite with gneissic banding, dry	25		
20		50/4		

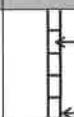



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-11		G S Technician: J. Patterson		
Date: 12/5/2017	Depth: 40 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	
22	Light brown light gray black weathered granodiorite with gneissic banding, dry	8		
		12		
24		17		
26		50/4		
28				
	Light gray black very fine micaceous SANDY SILT, with structure, dry			
30				
32	Light gray black micaceous SILT (weathered gneiss), dry	50/3		
34				
36				
38				
	No Return	50/1		
40				

Auger Refusal @ 40 ft.

270.0



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT. - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-14		G S Technician: J. Patterson				
Date: 12/7/2017	Depth: 42.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
42			Auger Refusal @ 42.5 ft.	277.5		



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.2 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-12		G S Technician: J. Patterson				
Date: 12/6/2017	Depth: 45.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
				330.0		
2						
	Red brown CLAYEY SILT, moist	8				
		7				
	Red brown micaceous SILT, moist	7				
4		8				
	Red brown CLAYEY SILT, moist	4				
	Red brown yellow SILT with horizontal structure, dry	6				
		8				
6	White black micaceous Silt with structure, dry	8				
		4				
	Light brown micaceous SILT, dry	5				
		7				
8		3				
	Light brown SILT, trace quartz fragments at 8.5 ft., horizontal structure, dry	4				
		6				
		6				
10		5				
12						
14	Light brown light gray SILT with sand, biotite rich at base with horizontal structure, dry	4				
		3				
		4				
16						
18						
	Light brown white micaceous SILT, dry	7				
		10				
20	White pink light brown very fine SANDY SILT with quartz fragments, dry	9				

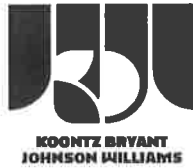


Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-12		G S Technician: J. Patterson				
Date: 12/6/2017	Depth: 45.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
22			Saturated @ 27 ft.	310.0		
24	Light brown light gray SILT with pink plagioclase banding at 24 ft., dry	21 13 12				Natural Formation
26						
28					303.0	
30	Light brown light gray white black SILT with horizontal banding, trace quartz fragments at base, saturated at 27 ft. (seen on rod)	12 18 23				1.25" ID PHand Slotted PVC Screen
32						
34	Light brown light gray white black SILT with horizontal banding, trace quartz fragments at base, saturated	12 12 25				Natural Formation
36						
38						
40	Light brown light gray white black SILT with horizontal banding, trace quartz fragments at top, saturated	50/5				



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT. - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-12		G S Technician: J. Patterson				
Date: 12/6/2017	Depth: 45.5 ft.	Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
42				284.50		Natural Formation 1.25" ID Hand Slotted PVC Screen Push Cap
44	Dark brown black micaceous SILT, saturated	50/3				

Auger Refusal @ 45.5 ft.



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-13		G S Technician: J. Patterson		
Date: 12/6-7/2017	Depth: 26 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core		
Depth	Soil/Rock Description	Blow Count	Remarks	305.0
2				
	Light brown brown CLAYEY SILT, trace organic matter at the top, wet	3		
		5		
		5		
4		6		
	Light brown light gray micaceous SILT with rock fragments at 4-5 ft., dry	20		
		17		
		16		
6		21		
	Light brown micaceous SILT, dry	7		
		10		
		17		
8		19		
	Light brown micaceous SILT, dry	13		
		14		
		14		
10		16		
12				
14	Light brown SILT with quartz fragments, dry	50/4		
	Light brown white fine to medium SAND with silt, dry			
16				
18				
	Light brown light gray micaceous SILT with biotite banding, dry	32		
		35		
20		50/4		



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-13		G S Technician: J. Patterson		
Date: 12/6-7/2017	Depth: 26 ft.	Boring Method: 3.25" ID H. S. Auger/Wireline Core		
Depth	Soil/Rock Description	Blow Count	Remarks	
22				
24	Light brown light gray SILT, trace biotite mica, horizontal structure, dry	50/3		
			Run 1: 25-26 ft. Recovery - 12/12" = 100% RQD - 0/12" = 0%	280.0
	Highly weathered micaceous SILT, dry			279.0



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 1.5 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-14		G.S. Technician: J. Patterson				
Date: 12/7/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
				320.0		
2						
		5				
	Light brown micaceous SILT, moist to dry	6				
4		11				
		14				
		8				
	Light brown red brown micaceous SILT structure at the base, dry	20				
6		28				
		26				
		16				
	Red brown light gray SILT with structure, trace biotite mica at base, dry	18				
8		17				
		23				
		20				
	Light brown SILT, trace rock fragments, horizontal structure, dry	24				
10		29				
		50/4				
12						
14	Light brown light gray black SILT, trace rock fragments at 14 ft., horizontal structure, dry	32				
		43				
		41				
16						
18						
	Light brown micaceous SILT, horizontal structure, dry	35				
20		50/3				

Push Cap

1.25 " ID Push Coupling PVC Pipe

Natural Formation

WELL CONSTRUCTION DETAILS

Push Cap

1.25" ID Push Coupling PVC Pipe

Natural Formation



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS	
Client: J. H. Martin		Driller: P. Smith					
Location: B-14		G S Technician: J. Patterson					
Date: 12/7/2017		Boring Method: 3.25" ID H. S. Auger					
Depth	Soil/Rock Description	Blow Count	Remarks				
22	Light brown light gray micaceous SILT, dry	50/2		287.50		<div>← Natural Formation</div>	
24							
26							
28							
	Light brown micaceous SILT, dry	27					1.25 " ID Push Coupling PVC Pipe
30	Red brown SANDY SILT, trace quartz fragments, dry	50/5					
32							Natural Formation
	Brown dark brown micaceous SANDY SILT, dry	14					
34		25					
		28					
36			Saturated @ 39 ft.	281.0			
38							
	Red brown black micaceous SILT, wet to saturated	20					
40	Red brown micaceous SANDY SILT, saturated	50/6					



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-15		G S Technician: J. Patterson		
Date: 12/8/2017	Depth: 11 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	283.0
2				
	Light brown micaceous SILT, dry	4		
	Dark gray dark brown biotite rich SILT with structure, dry	8		
4		20		
		45		
	Light brown light gray micaceous SILT, dry	30		
		39		
6		50/6		
	Gray brown white micaceous SILT, dry	29		
		40		
8	Gray brown white micaceous SANDY SILT, trace rock fragments, dry	50/3		
	Dark gray brown biotite rich micaceous SILT, trace rock fragments, dry	35		
		50/4		
10				

Auger Refusal @ 11 ft.

272.0



KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-16		G S Technician: J. Patterson		
Date: 12/8/2017	Depth: 30 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	
2				
		3		
	Red brown micaceous SILT, dry	3		
4		3		
		5		
		4		
	Red brown micaceous SILT, dry	6		
6		5		
		7		
	Light brown micaceous SILT, dry	6		
		8		
	White light brown micaceous SILT, dry	5		
8		7		
		6		
	White light brown micaceous SILT, dry	7		
		6		
10		7		
12				
14				
	Light brown light gray micaceous SILT, dry	6		
		7		
		8		
16				
18				
		6		
20	Light brown light gray micaceous SILT, some white plagioclase, dry	9		
		10		



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-16		G S Technician: J. Patterson		
Date: 12/8/2017	Depth: 30 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	313.0
22				
	Light brown brown gray micaceous SILT, trace rock fragments, dry	39 50/3		
24				
26				
28				
	Light brown light gray micaceous SANDY SILT, dry	50/3		
30				283.0

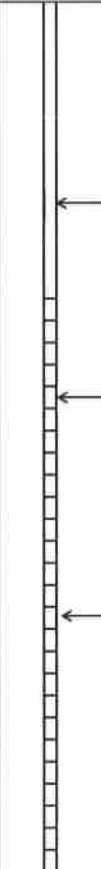
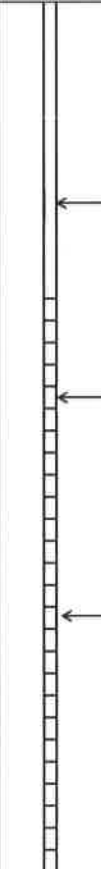
Auger Reusal @ 30 ft.

283.0



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 2.2 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-17		G S Technician: J. Patterson				
Date: 12/12/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks	380.0		
2						
		4				
		7				
	Red brown micaceous SILT, moist	11				
4		14				
		5				
	Red brown micaceous SILT, trace quartz fragments at top of sample, moist	8				
		11				
6		13				
		4				
	Red brown micaceous SILT, dry	4				
		4				
8		4				
		3				
	Red brown light brown micaceous SILT with sand, dry	4				
		5				
10		7				
12						
14	Red brown light brown micaceous SILT, structure at base, dry	3				
		3				
		4				
16						
18						
	Red brown micaceous SILT, dry	3				
		4				
20	Brown black micaceous SILT, dry	3				



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-17		GS Technician: J. Patterson				
Date: 12/12/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
22			Saturated @ 33.5 ft.	353.0		Natural Formation
	Red brown micaceous SILT, dry	3				
		4				
24	Dark brown SANDY SILT, dry	6				
26						
28						
30	Light gray gray micaceous SANDY SILT, dry	12				
		18				
		14				
32						
	Light brown light gray gray black micaceous SANDY SILT (weathered gneiss) with quartz fragments, saturated @ 33.5 ft.	10				
34		19				
		25				
				346.5		Natural Formation
36						
38						
	Light brown light gray gray black micaceous SANDY SILT (weathered gneiss) with quartz fragments, saturated	40				
40		50/4				


Saturated @ 33.5 ft.

Natural Formation

1.25" ID Hand Slotted PVC Screen

Natural Formation



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-17		G S Technician: J. Patterson				
Date: 12/12/2017		Boring Method: 3.25" ID H. S. Auger				
Depth	Soil/Rock Description	Blow Count	Remarks			
42						
44	Biotite rich SANDY SILT with quartz fragments, saturated (minor anticlinal with arch towards top of spoon)	27 50/3				1.25" ID Hand Slotted PVC Screen
46						
Auger Refusal @ 47.0 ft.				333.0		Push Cap

1.25" ID Hand Slotted PVC Screen

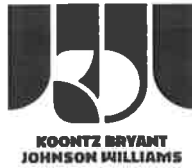
Push Cap



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 0.8 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-18		G S Technician: J. Patterson				
Date: 12/14/2017		Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
				368.0		Push Cap
2		3				
	Red brown SILT, moist	7				
4		9				
		13				
	Red brown SILT, trace rock fragments, moist	5				
6		12				
		17				
		20				
	Red brown SILT, trace rock fragments, moist	8				
8		13				
		12				
		12				
	Red brown light gray SILT, dry	5				
10		10				1.25" ID Push Coupling PVC Pipe
		12				
		14				
12						
14	Red brown dark brown micaceous SILT, structure at base of sample, dry	2				
		2				
		3				Natural Formation
16				353.0		
18						
	Red brown dark brown micaceous SILT, dry	2				
		4				
20	Light gray SILT, wet	8				1.25" ID Hand Slotted PVC Screen



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-18		G S Technician: J. Patterson				
Date: 12/14/2017		Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
			Saturated @ 21 ft.	347.0		
22						
	Light brown light gray micaceous weathered GNEISS with quartz banding, saturated (slight anticlinal folding at top of sample)	7 41 50/1				
24						
26						
28						
	Red brown dark gray SANDY SILT with quartz fragments, saturated	50/2				
30						
	30-30.7 ft. - Fine grained banded GNEISS with biotite & muscovite, minor fractures at 45° & 90° (water staining of fractures noted), saturated		Auger Refusal @ 30 ft.	338.0		
32	30.7-31.6 ft. - Muscovite rich SCHIST, trace quartz fragments at 31.2 ft. & 31.5 ft. saturated		Run 1: 30-35 ft. Recovery - 30/60" = 50% RQD - 8/60" = 13%			
34	21.5-32.5 ft. - Biotite rich SCHIST with quartz fragments, some muscovite, saturated					
36	35-36.3 ft. - Weathered biotite rich GNEISS with water stained folding, saturated					
	36.3-36.4 ft. - Weathered quartz, sat.		Run 2: 35-40 ft. Recovery - 61.5/60" = 103% RQD - 41/60" = 68%			
38	36.4-37.1 ft. - Biotite rich quartz banded GNEISS with minor stained fractures, sat.					
	37.1-37.2 ft. - Highly weathered biotite rich GNEISS, saturated					
	37.2-40 ft. - Biotite rich GNEISS with some folding & quartz banding, sat.					
40				328.0		
Total Depth @ 40 ft.						



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-19		G S Technician: J. Patterson		
Date: 12/13/2017	Depth: 46.5 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	358.0
2				
		5		
		8		
	Light gray light brown SILT, dry	13		
4		15		
		10		
	Light gray light brown SILT with sand, dry	22		
		43		
6		50/3		
	Light gray light brown SILT, dry	50/2		
8				
		25		
	Light gray light brown micaceous SILT, trace structure at base, dry	29		
		50/5		
10				
12				
14	Light gray light brown micaceous SILT, trace structure at base, dry	28		
		50/2		
16				
18				
	Light brown light gray micaceous SILT, dry	50/6		
20				



KOONTZ BRYANT
JOHNSON WILLIAMS

Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-19		G S Technician: J. Patterson		
Date: 12/13/2017	Depth: 46.5 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	
22				
24	Dark brown biotite rich SANDY SILT, horizontal	50/5		
	structure, dry			
26				
28				
	Dark brown biotite rich SANDY SILT, horizontal	33		
	structure, dry	50/3		
30	Light brown SANDY SILT, dry			
32				
34	Light brown brown SANDY SILT, dry	50/3		
36				
38				
	Light brown brown SANDY SILT, dry	50/1		
40				



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)
Client: J. H. Martin		Driller: P. Smith		
Location: B-19		G S Technician: J. Patterson		
Date: 12/13/2017	Depth: 46.5 ft.	Boring Method: 3.25" ID H. S. Auger		
Depth	Soil/Rock Description	Blow Count	Remarks	
42				
44	Light brown brown SANDY SILT, dry	50/1		
46				

311.5

Auger Refusal @ 46.5 ft.



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	Stickup: 0.6 ft.	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-20		G S Technician: J. Patterson				
Date: 12/13/ & 15/2017		Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
				320.0		
2						
	Gray micaceous SILT with quartz fragments at base, dry	14 30 50/4				
4	Light brown SILT, some quartz fragments, dry	15 50/5				
6						
	Red brown SANDY SILT, trace quartz fragments, dry	13 25				
8	Black brown white micaceous SANDY SILT with quartz fragments, dry	26 37				
	Light gray SANDY SILT, trace quartz fragments at top of sample, dry	15 35 50/4				
10						
12						
14	Light gray gray micaceous SANDY SILT with quartz fragments, dry	33 50/5				
16						
18						
20	Brown gray black micaceous SILT, trace quartz fragments, dry	40 43 50/4				

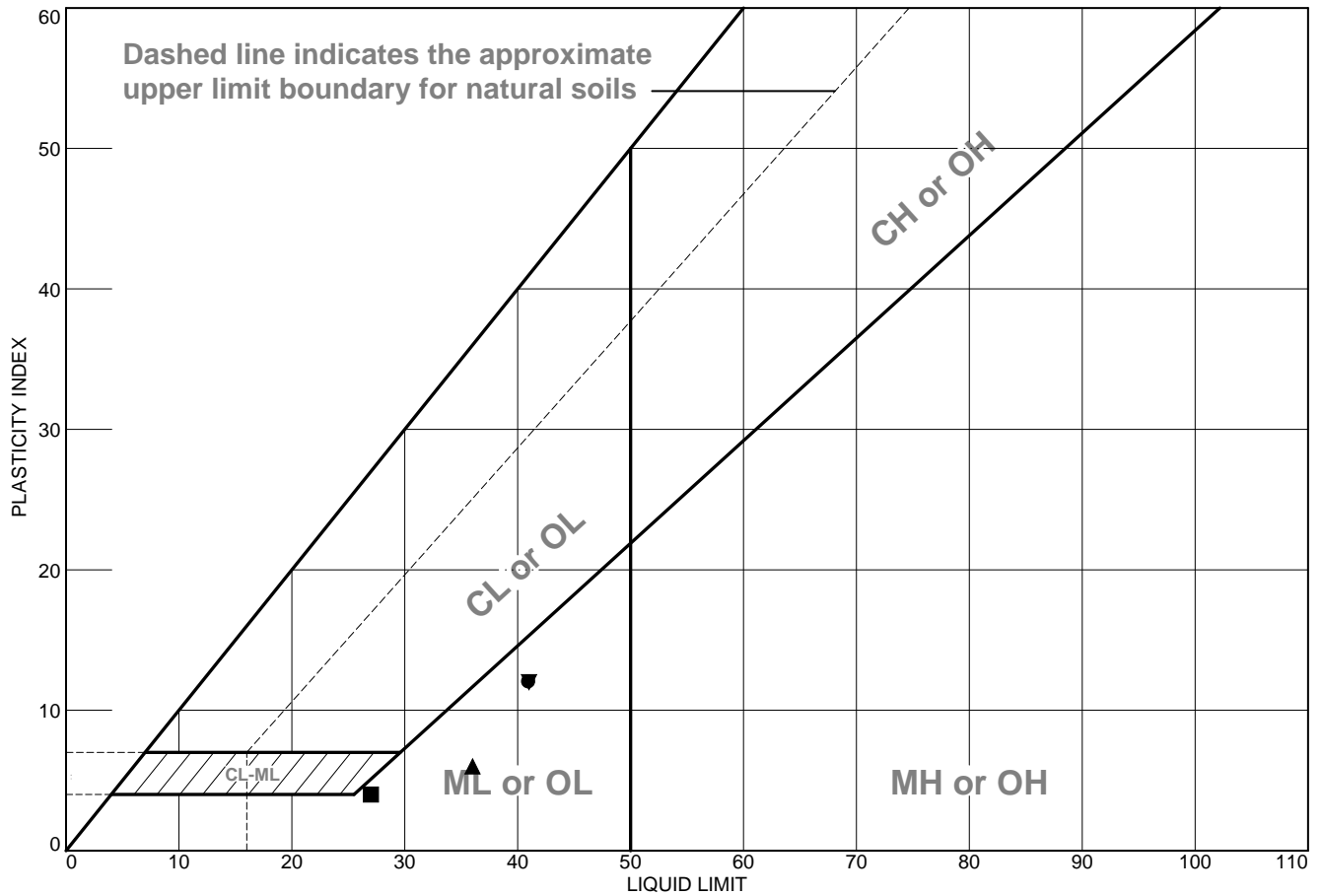


Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)		WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-20		G S Technician: J. Patterson				
Date: 12/13/ & 15/2017		Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
22						
24	Light brown SANDY SILT with quartz fragments at the top of the sample, with structure, dry	19 50/3				
26						Natural Formation
28						
30	Light brown gray black micaceous SILT, dry	50/6				1.25 " ID Push Coupling PVC Pipe
32						
34	Light brown light gray micaceous SILT, dry	12 50/5		287.0		
36						
38						1.25" ID Hand Slotted PVC Screen
40	Quartz rich GNEISS with pink plagioclase feldspar		Auger refusal @ 38 ft. Run 1: 38-43 ft. Recovery - 22/60" = 37% RQD - 0/60" = 0%	282.0		Rock



Project: CC-1100		Drilling Company: Blue Ridge Drilling, Inc.		ELEVATION (FT - AMSL)	<div></div>	WELL CONSTRUCTION DETAILS
Client: J. H. Martin		Driller: P. Smith				
Location: B-20		G S Technician: J. Patterson				
Date: 12/13/2017		Boring Method: 3.25" ID H. S. Auger/Wireline Core				
Depth	Soil/Rock Description	Blow Count	Remarks			
42	Biotite rich GNEISS with quartz banding, weathered to highly weathered, dry		Run2: 43-48 ft. Recovery - 36/60" = 60% RQD - 14/60" = 23%	272.0	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><d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LIQUID AND PLASTIC LIMITS TEST REPORT

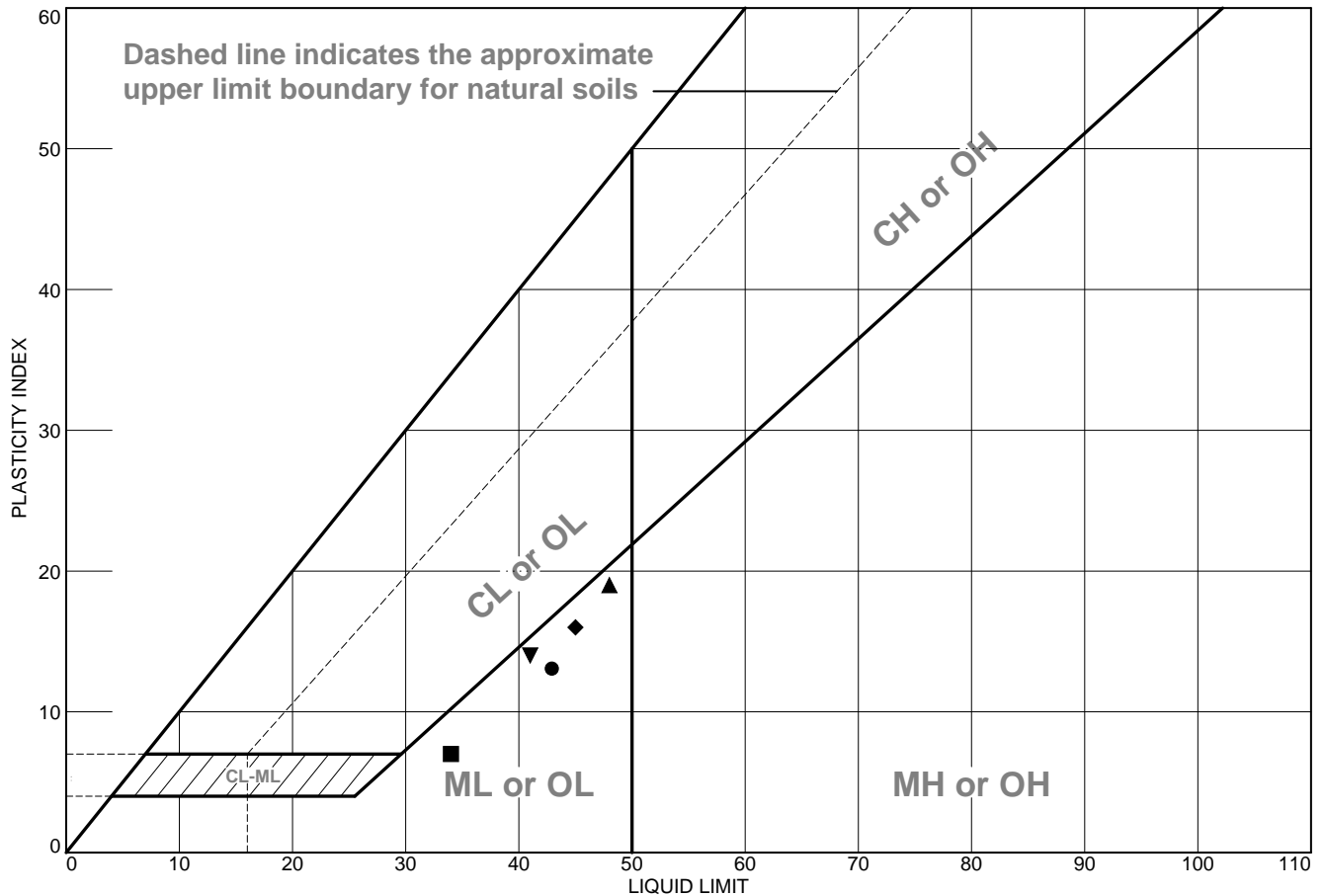


	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	red brown, moist, Silt with sand (ML)	41	29	12		72.9	ML
■	light brown, moist, friable, Silty Sand (SM)	27	23	4		39.1	SM
▲	yellow brown, moist, sandy Silt with trace rock fragments	36	30	6		58.3	ML
◆	light brown and white, dry, Silty Sand (SM)	18	NP	NP		31.6	SM
▼	light gray and light brown, mica, sandy Silt (ML)	41	29	12		62.2	ML
Project No. 2017890 Client: CWV LLC					Remarks:		
Project: Cumberland Property							
●Location: B-1 Depth: 8'-10' Sample Number: 1							
■Location: B-1 Depth: 28'-30' Sample Number: 2							
▲Location: B-2 Depth: 14'-15' Sample Number: 3							
◆Location: B-4 Depth: 4'-5' Sample Number: 4							
▼Location: B-6 Depth: 18'-20' Sample Number: 5					Figure		
Geo-Solutions							
Hopewell, Virginia							

Figure

Tested By: CCL Checked By: BEJ

LIQUID AND PLASTIC LIMITS TEST REPORT

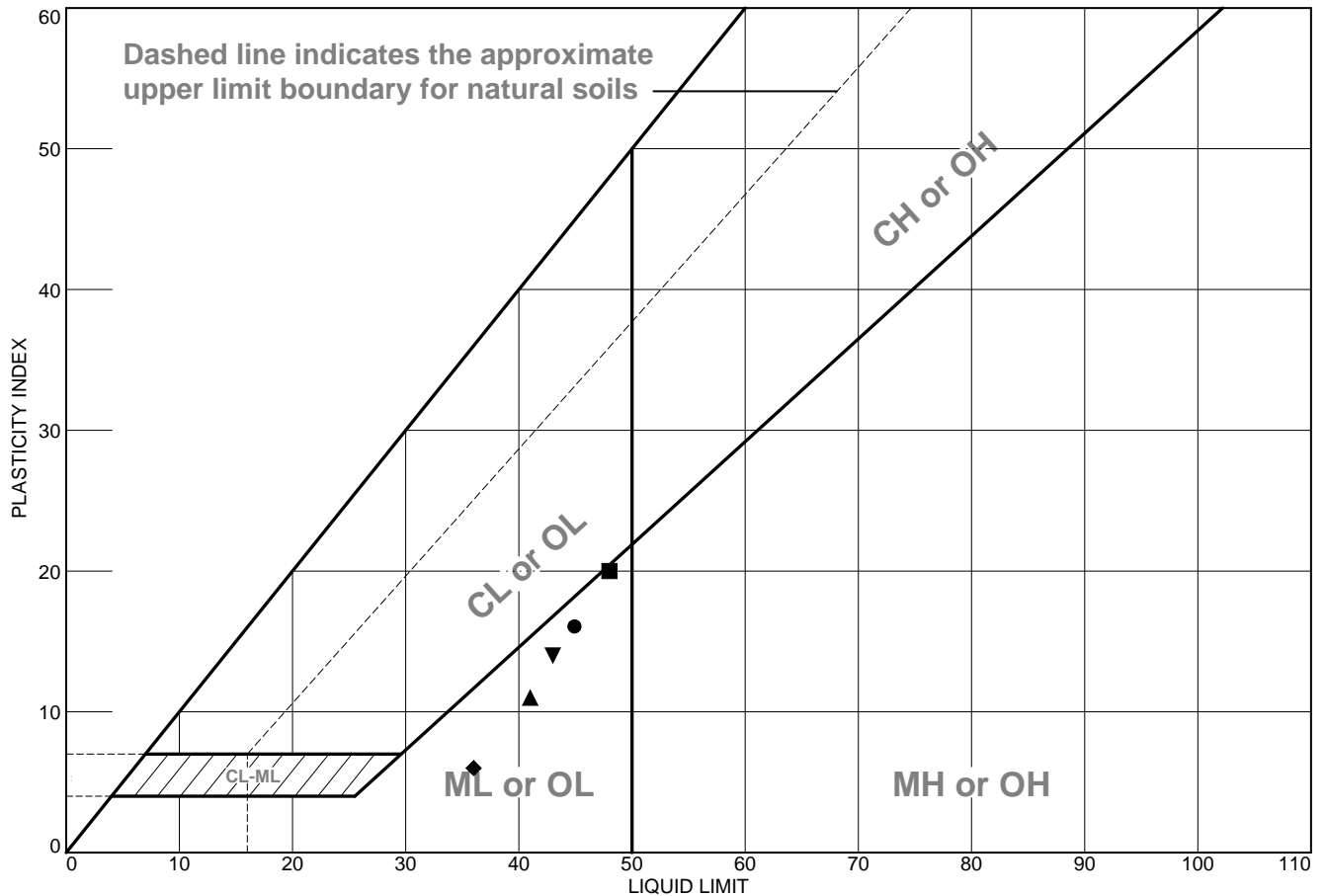


MATERIAL DESCRIPTION		LL	PL	PI	%<#40	%<#200	USCS
●	light brown and gray, dry, friable, sandy Silt (ML)	43	30	13		58.4	ML
■	light brown and white, mica, dry, sandy Silt (ML)	34	27	7		55.1	ML
▲	light brown, dry, mica, sandy Silt (ML)	48	29	19		64.9	ML
◆	light gray and light brown, mica, Silt with sand (ML)	45	29	16		70.2	ML
▼	light brown and light gray, dry, Silt with sand (ML)	41	27	14		62.2	ML
Project No. 2017890 Client: CWV LLC					Remarks:		
Project: Cumberland Property							
●Location: B-7		Depth: 8'-9'	Sample Number: 6				
■Location: B-7		Depth: 34'-36'	Sample Number: 7				
▲Location: B-8		Depth: 8'-10'	Sample Number: 8				
◆Location: B-10		Depth: 6'-8'	Sample Number: 9				
▼Location: B-12		Depth: 14'-16'	Sample Number: 10				
Geo-Solutions					Figure		
Hopewell, Virginia							

Figure

Tested By: CCL Checked By: BEJ

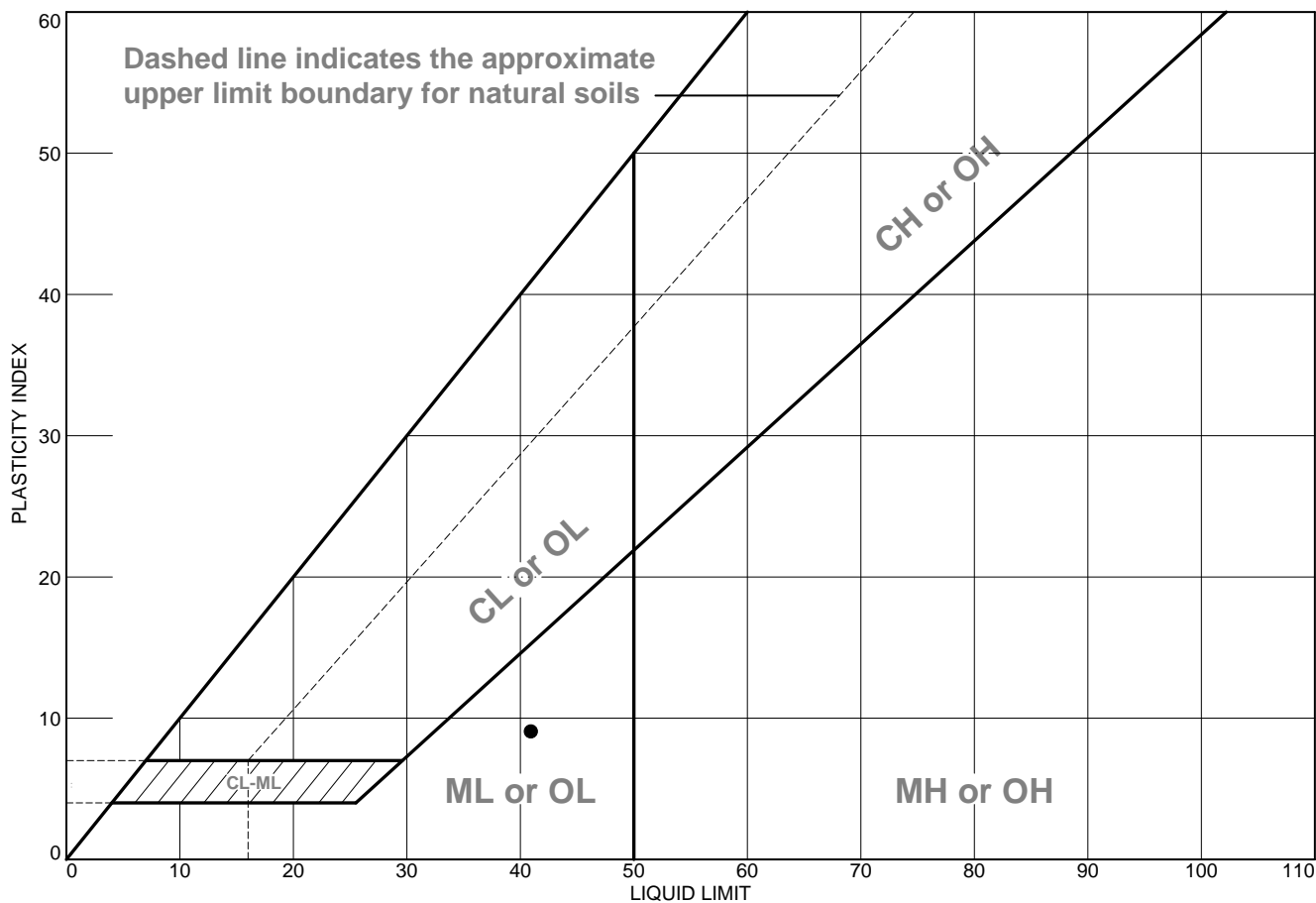
LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	light brown, dry, Silt (ML)	45	29	16		74.9	ML
■	red brown, mica, Silt (ML)	48	28	20		77.3	ML
▲	red brown and light brown, mica, Silt with sand (ML)	41	30	11		64.1	ML
◆	light gray and gray, mica, dry, sandy Silt (ML)	36	30	6		54.7	ML
▼	light gray and light brown, dry, Silt with sand (ML)	43	29	14		62.3	ML
Project No. 2017890 Client: CWV LLC					Remarks:		
Project: Cumberland Property							
●Location: B-13		Depth: 6'-8'	Sample Number: 11				
■Location: B-16		Depth: 4'-6'	Sample Number: 12				
▲Location: B-17		Depth: 8'-10'	Sample Number: 13				
◆Location: B-17		Depth: 28'-30'	Sample Number: 14				
▼Location: B-19		Depth: 4'-6'	Sample Number: 15				
Geo-Solutions					Figure		
Hopewell, Virginia							

Tested By: CCL Checked By: BEJ

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	red brown and brown, sandy Silt (ML) w/ rock fragments	41	32	9		58.4	ML

Project No. 2017890	Client: CWV LLC
----------------------------	------------------------

Project: Cumberland Property

● **Location:** B-20 **Depth:** 6'-8' **Sample Number:** 16

Geo-Solutions

Hopewell, Virginia

Remarks:

Figure

Tested By: CCL

ATTACHMENT PTA-XII - LOCATION OF BORINGS AND BORING LOGS

In accordance with §9 VAC 20-81-460.E.2.a., a map showing boring locations, along with the corresponding DAA boring logs is presented herein. KBJW boring logs are contained in Appendix 2 of the Hydrogeologic Report.

Table 1 presented in this attachment provides completion details, groundwater and bedrock elevation data for both DAA and KBJW borings and piezometers.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. Responses on TR 1 were provided to DEQ on October 1, 2021 (Comments 1 – 10, 12 -13 and 17 - 22) with a TR 1 supplement issued on April 13, 2022 (Comments 11, and 14-16). In order to respond to TR 1, two additional borings were completed, DAA-101pz and DAA-112pz. Information on these borings is now included in this attachment.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022, with a supplement to TR 2 issued on October 25, 2022. No comments were received on this attachment.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this attachment.

This information is incorporated here as part of the Final Part A Submission.

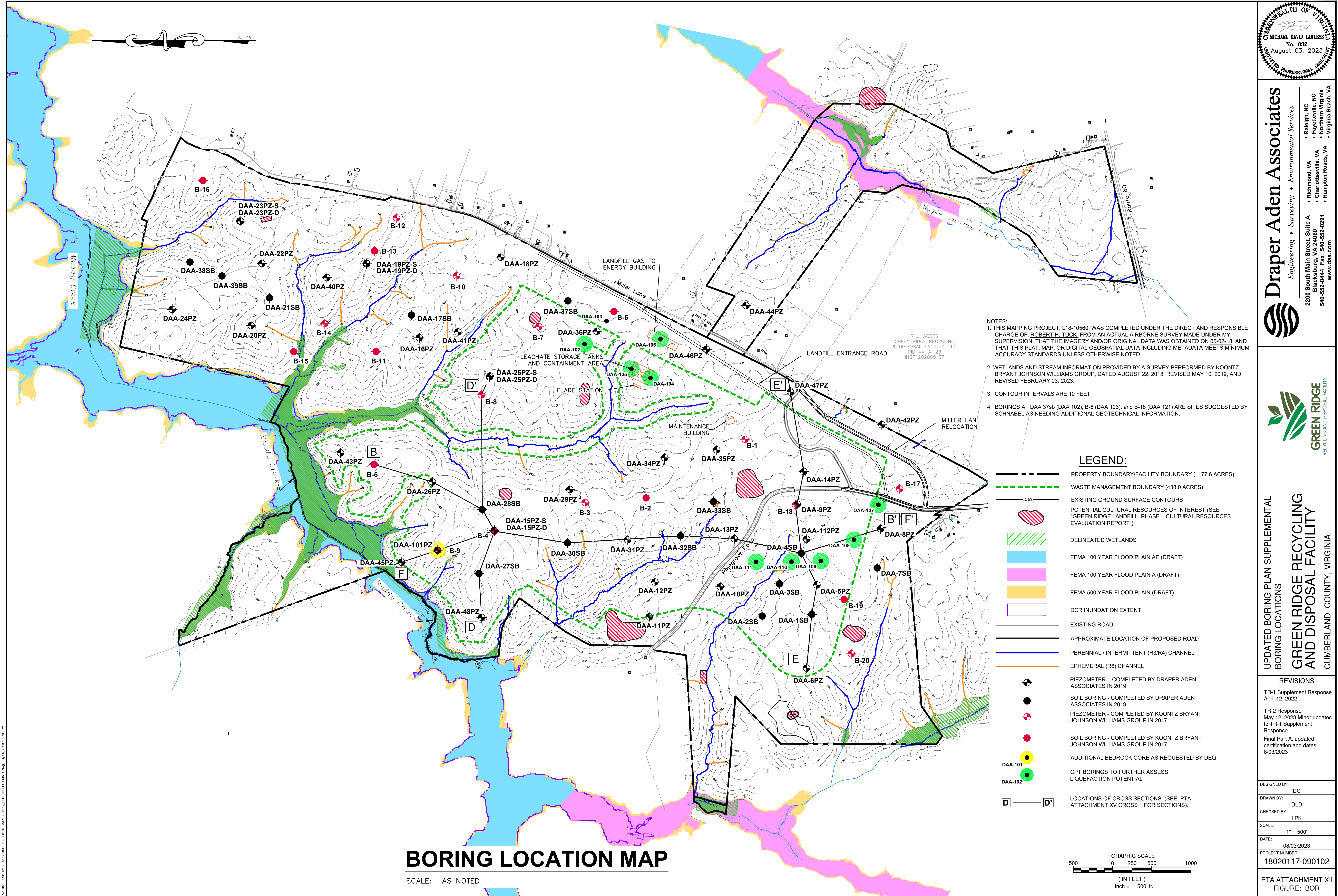
The following is a list of the documents associated with this section:

- PTA Attachment XII Figure: BOR – Boring Location Map, dated August 3, 2023
- Boring Logs
- Table 1 – Boring Log Completion Details - Dated 04/12/2022

ATTACHMENT 1

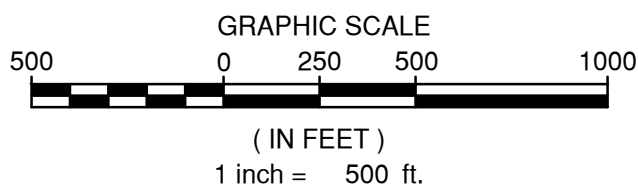
PTA ATTACHMENT XII FIGURE: BOR – BORING LOCATION MAP

DATED AUGUST 3, 2023



NOTES:
1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK, FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND REVISED FEBRUARY 03, 2023.
3. CONTOUR INTERVALS ARE 10 FEET.
4. BORINGS AT DAA 37sb (DAA 102), B-6 (DAA 103), and B-18 (DAA 121) ARE SITES SUGGESTED BY SCHNABEL AS NEEDING ADDITIONAL GEOTECHNICAL INFORMATION.

- LEGEND:**
- PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES)
 - WASTE MANAGEMENT BOUNDARY (438.0 ACRES)
 - EXISTING GROUND SURFACE CONTOURS
 - POTENTIAL CULTURAL RESOURCES OF INTEREST (SEE "GREEN RIDGE LANDFILL, PHASE 1 CULTURAL RESOURCES EVALUATION REPORT")
 - DELINEATED WETLANDS
 - FEMA 100 YEAR FLOOD PLAIN AE (DRAFT)
 - FEMA 100 YEAR FLOOD PLAIN A (DRAFT)
 - FEMA 500 YEAR FLOOD PLAIN (DRAFT)
 - DCR INUNDATION EXTENT
 - EXISTING ROAD
 - APPROXIMATE LOCATION OF PROPOSED ROAD
 - PERENNIAL / INTERMITTENT (R3/R4) CHANNEL
 - EPHEMERAL (R6) CHANNEL
 - PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
 - SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019
 - PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
 - SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017
 - ADDITIONAL BEDROCK CORE AS REQUESTED BY DEQ
 - CPT BORINGS TO FURTHER ASSESS LIQUEFACTION POTENTIAL
 - LOCATIONS OF CROSS SECTIONS. (SEE PTA ATTACHMENT XV CROSS 1 FOR SECTIONS).



ATTACHMENT 2

BORING LOGS

BORING/WELL LOG

Boring/Well ID: **DAA-2sb**

Page 1 of 2

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726996.95	Sampling Method:	Split Spoon
Start Date:	02/25/19	Easting:	11589988.63	Well Material:	NA
Completion Date:	02/25/19	Ground Elevation:	355.61	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	51.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some fine SAND, little Clay (MH)				Logged Cuttings from 0-6'
		5				350.61	
5	2						Loose
	3						
	2						
5	2		Brown fine SAND, some Silt, micaceous, Dry (SM)				
	3						
	4						
	3	10				345.61	
6	3						Loose
	3						
	5						
7	3						
	4						
	3						
	3						
9	4	15				340.61	Loose
	5						
6	6		Red to brown fine SAND, little Silt, trace Clay, micaceous (SM)				
	3						
	3						
	6						
	5						
12	5						Medium Dense
	7						
	11	20				335.61	
	7						
20	9						
	11						
	13						
	8						
21	11						Medium Dense
	10						
	10						
	8						
24	9	25				330.61	
	15						
	12						
	7						
23	11		Light Tan to gray very fine SAND, some Silt, bands of biotite, micaceous, dry (SM)				Medium Dense
	12						
	8						
	6						
21	10						
	11						
	11						
	12	30				325.61	
21	10						Medium Dense
	11						
	21						
	8						
24	9						
	15						
	28						
	13						
	14						

BORING/WELL LOG

Boring/Well ID: **DAA-2sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726996.95	Sampling Method:	Split Spoon
Start Date:	02/25/19	Easting:	11589988.63	Well Material:	NA
Completion Date:	02/25/19	Ground Elevation:	355.61	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	51.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
36	16 28 6 13 23 50/6"		Light Tan very fine SAND, some Silt, bands of biotite, micaceous, dry (SM)				Dense
>50	35 50/4"						
		40	Light Tan to white fine SAND, little Silt, SAPROLITE (SM)			315.61	
>50	21 33 50/6"						Very Dense
		45				310.61	
			Brown to gray fine SAND, some Silt, trace white quartzite gravel, SAPROLITE (SM)				
>50	28 50/3"						Very Dense
		50				305.61	
			Auger Refusal at 51.5'				
		55				300.61	
		60				295.61	
		65				290.61	



Boring/Well ID: **DAA-3sb**

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726777.44	Sampling Method:	Split Spoon
Start Date:	02/25/19	Easting:	11590399.87	Well Material:	NA
Completion Date:	02/25/19	Ground Elevation:	348.39	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	60'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
		5				343.39	
15	3 6 9 12						Stiff
2	3 3 6 8 9 9 9	10				338.39	
3	3 3 3 3 3 3 3						Medium Stiff
4	3 3 3 3 3 3 5						
5	3 3 3 3 3 3 5	15				333.39	Medium Stiff
6	2 2 2 2 3 3 4		Reddish brown SILT, some Clay, little fine Sand, iron bands, damp, (MH)				
7	3 3 3 3 3 5						Medium Stiff
8	wh 3 4 4 4 3 3	20				328.39	
9	3 3 3 3 4						Medium Stiff
10	wh 3 3 3 3	25				323.39	
11	wh 3 3 3 3						Medium Stiff
12	wh 12 3 4						
13	wh 1 4 5	30				318.39	Soft

BORING/WELL LOG

 Boring/Well ID: **DAA-3sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726777.44	Sampling Method:	Split Spoon
Start Date:	02/25/19	Easting:	11590399.87	Well Material:	NA
Completion Date:	02/25/19	Ground Elevation:	348.39	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	60'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
14	3 3 8 10						Stiff
15	wh 3 4 5	40				308.39	Medium Stiff
16	4 7 9 8	45				303.39	Stiff
17	3 3 4 7	50	Brown SILT, some Clay, little very fine Sand, wet (MH)			298.39	Medium Stiff
18	5 6 8 10	55				293.39	Medium Stiff
19	4 7 9 13	60	No Auger Refusal, Drilling depth terminated at 60'			288.39	Medium Stiff
		65				283.39	

Boring/Well ID: **DAA-4sb**

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BORING/WELL LOG

Boring/Well ID: **DAA-4sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726498.37	Sampling Method:	Split Spoon
Start Date:	02/26/19	Easting:	11590790.11	Well Material:	NA
Completion Date:	02/26/19	Ground Elevation:	347.44	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	39'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	22 50/6"		Brown fine SAND, little Silt, little Clay, biotite bands, white quartzite coarse Sand lenses, <i>SAPROLITE</i> (SM)				Very Dense
>50	50/4"		Auger Refusal at 39'				Very Dense
		40				307.44	
		45				302.44	
		50				297.44	
		55				292.44	
		60				287.44	
		65				282.44	

BORING/WELL LOG

Boring/Well ID: **DAA-5pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726297.92	Sampling Method:	Split Spoon
Start Date:	02/26/19	Easting:	11590385.49	Well Material:	2" Schedule 40 PVC
Completion Date:	02/26/19	Ground Elevation:	356.49	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	35.5	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	356.50	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red fine SAND and Silt, some Clay (ML)				Logged Cuttings from 0-7'
31	6 12 19 50/6"	5				351.49	
			Light Tan to Red fine SAND, little Silt, trace gravel, Micaceous (SM)				Dense
	Shelby Tube	10				346.49	
>50	65/4"						Very Dense
		15				341.49	
>50	25 50/6"						Very Dense
		20				336.49	
>50	65/4"						
		25	Light Tan fine to med SAND, little Silt, Micaceous, Damp, SAPROLITE (SM)			331.49	Very Dense
>50	50/2"						
		30				326.49	Very Dense
>50	50/1"						
			Auger Refusal at 35.5'				

BORING/WELL LOG

Boring/Well ID: **DAA-6pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726430.01	Sampling Method:	Split Spoon
Start Date:	02/26/19	Easting:	11589325.34	Well Material:	2" Schedule 40 PVC
Completion Date:	02/26/19	Ground Elevation:	332.92	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	23.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	335.19	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SAND, some Silt, some Clay (ML)				Logged Cuttings from 0-6'
			Light brown fine SAND, some Silt, trace Clay, Micaceous (SM)			327.92	Loose
7	2						Loose
	3						
	4						
	6						
8	4						
	4						
	4						
	5						
	4	10	Light brown fine SAND, some Silt, trace Clay, biotite bands, Micaceous (SM)			322.92	Medium Dense
15	5						Very Dense
	10						
	20						
>50	31		Very light tan fine SAND, little Silt, Micaceous (SM)				
	50/6"						
		15				317.92	Dense
30	10						Very Dense
	14						
	16						
	26						
	10						
>50	24		Light brown fine SAND, some Silt, trace Clay, iron and biotite bands, Micaceous, SAPROLITE (SM)				Very Dense
	50/6"	20				312.92	Very Dense
>50	50/6"						
			Auger Refusal at 23.5'				
		25				307.92	
		30				302.92	

BORING/WELL LOG

Boring/Well ID: **DAA-7sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3725536.82	Sampling Method:	Split Spoon
Start Date:	02/27/19	Easting:	11590630.30	Well Material:	NA
Completion Date:	02/27/19	Ground Elevation:	352.90	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	63.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
15	4 6 9 7	5	Brown SILT, some Clay, trace Sand (SM)			347.90	Logged Cuttings from 0-5' Medium Dense
19	9 11 8 9 7	10	Green to gray fine SAND, little Silt, trace Clay, mottling (SM)			342.90	Medium Dense
21	11 10 12 8	15				337.90	Medium Dense
19	9 10 14 5						
24	9 15 27						
66	17 36 30 31	20				332.90	Very Dense
28	6 13 15 32		Light tan to brown SAND, some Silt, biotite mica bands, mottled (SM)				
>50	50/4"						
>50	50/2"	25				327.90	Very Dense
>50	17 50/6"	30	Tan fine SAND, some Silt, white quartzite gravel and biotite mica lenses, mottled (SM)			322.90	Very Dense

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3725536.82	Sampling Method:	Split Spoon
Start Date:	02/27/19	Easting:	11590630.30	Well Material:	NA
Completion Date:	02/27/19	Ground Elevation:	352.90	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	63.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	26 38 50/5+		Tan fine SAND, some Silt, white quartzite gravel and biotite mica lenses, mottled (SM)				Very Dense
>50	33 50/3"	40				312.90	Very Dense
16	4 7 9 13	45				307.90	Medium Dense
23	6 9 14 24	50	Red brown SILT, some fine Sand, little Clay, mottled (SM)			302.90	Medium Dense
26	5 11 14 19	55				297.90	Medium Dense
18	8 9 9 23	60	Red SILT, some Clay, little Sand (SM)			292.90	Medium Dense
			Auger Refusal at 63.5'				
		65				287.90	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726549.74	Sampling Method:	Split Spoon
Start Date:	02/27/19	Easting:	11591416.33	Well Material:	2" Schedule 40 PVC
Completion Date:	02/27/19	Ground Elevation:	364.19	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	36.0	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	365.46	Seal:	Bentonite Pellets/Hydrated



N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
		5	Red SILT, some Clay, trace fine Sand (ML)			359.19	
4	2 2 3 wh		Red/Brown fine to med SAND and Silt, trace Clay, micaceous, Damp (SM)				Medium Stiff
2	2 2 3	10				354.19	
	Shelby Tube						Medium Stiff
4	wh 2 2 4		Brown to gray fine to med SAND, little Silt, micaceous, iron and biotite bands, Wet (SM)				
	Shelby Tube	15				349.19	
							Stiff
10	2 4 6 8	20				344.19	Medium Dense
12	4 6 6 11						
	Shelby Tube						
32	13 14 18 20	25				339.19	Dense
							Very Dense
>50	11 37 50/4"		Light Gray to dark brown fine SAND, some Silt, white quartz gravel lenses SAPROLITE (SM)				
		30				334.19	Very Dense
>50	23 32 50/5"						

BORING/WELL LOG

Boring/Well ID: **DAA-8pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726549.74	Sampling Method:	Split Spoon
Start Date:	02/27/19	Easting:	11591416.33	Well Material:	2" Schedule 40 PVC
Completion Date:	02/27/19	Ground Elevation:	364.19	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	36.0	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	365.46	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	50/4"		Auger Refusal at 36'				Very Dense
		40				324.19	
		45				319.19	
		50				314.19	
		55				309.19	
		60				304.19	
		65				299.19	

BORING/WELL LOG

Boring/Well ID: **DAA-9pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3725486.86	Sampling Method:	Split Spoon
Start Date:	02/28/19	Easting:	11591101.07	Well Material:	2" Schedule 40 PVC
Completion Date:	02/28/19	Ground Elevation:	365.25	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	25'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	365.68	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				Logged Cuttings from 0-6'
8	2354	5	Red/brown fine SAND and Silt, trace Clay, micaceous (SM)			360.25	Loose
5	2232	10	Red/Brown fine SAND, little Silt, micaceous, white quartz lenses (SM)			355.25	Loose
5	2233						Loose
5	2233						Loose
5	2233						Loose
5	2233						Loose
5	2233	15				350.25	Medium Dense
9	4345						Medium Dense
12	6667	20				345.25	Medium Dense
17	6698		Brown fine SAND, some Silt, white quartz sand lenses, SAPROLITE (SM)				Very Dense
>50	50/4"	25	Auger Refusal at 25'			340.25	
		30				335.25	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726549.74	Sampling Method:	Split Spoon
Start Date:	02/28/19	Easting:	11591416.33	Well Material:	2" Schedule 40 PVC
Completion Date:	02/28/19	Ground Elevation:	339.45	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	31'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	341.55	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Gray/Green SILT, little fine Sand, little Clay (MH)				Logged Cuttings from 0-6'
		5	Red/Brown SILT, little fine Sand, little Clay (MH)			334.45	
49	18 16 33 49 12						Very Dense
49	18 31 50/5"	10	Light Brown fine SAND, some Silt, gray/white quartz sand lenses (SM)			329.45	Very Dense
>50	25 40 50/5"	15				324.45	Very Dense
>50	33 50/5"	20	Light brown SILT and fine Sand, dry, SAPROLITE (SM)			319.45	Very Dense
24	13 13 11 18 29 50/2"	25	Dark brown fine SAND, little Silt, gray quartz sand lenses; SAPROLITE (SM)			314.45	
>50	50/5"	30				309.45	
>50			Auger Refusal at 31'				

BORING/WELL LOG

Boring/Well ID: **DAA-11pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3728437.13	Sampling Method:	Split Spoon
Start Date:	02/28/19	Easting:	11589977.41	Well Material:	2" Schedule 40 PVC
Completion Date:	02/28/19	Ground Elevation:	335.07	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	23'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	336.30	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				Logged Cuttings from 0-6'
		5	Red SILT, little fine Sand, dry, weathered, SAPROLITE (SM)			330.07	
>50	24 50/3"						Medium Dense
>50	50/3"						Medium Dense
		10				325.07	
		15				320.07	Dense
>50	50/3"						
		20	Light brown fine SAND, trace Silt, white quartz sand lenses, SAPROLITE, (SM)			315.07	Very Dense
>50	50/5"						
			Auger Refusal at 23'				
		25				310.07	
		30				305.07	



Boring/Well ID: **DAA-12pz**

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N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red/Brown fine SAND, some Silt (SM)				Logged Cuttings from 0-6'
		5				325.07	
12	4 5 7 6 5		Red/Brown fine to med SAND, some Silt, trace gravel (SM)				
15	7 8 7 4	10	Light Tan fine SAND, some Silt, micacious, (SM)			320.07	
16	7 9 8 6 8		Light Tan fine SAND, some Silt, micacious, white quartz sand lenses (SM)				
21	13 14 9						
25	10 15 14 9	15				315.07	
24	12 12 15 7						
24	8 16 43 14	20	Gray fine SAND, little Silt, white quartz sand lenses, iron and biotite bands, <i>SAPROLITE</i> (SM)			310.07	Very Dense
>50	50/3"						
		25	Auger Refusal at 25.5'			305.07	
>50	50/4"						
		30				300.07	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727352.27	Sampling Method:	Split Spoon
Start Date:	03/04/19	Easting:	11590973.86	Well Material:	2" Schedule 40 PVC
Completion Date:	03/04/19	Ground Elevation:	357.96	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	34'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	359.36	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay (MH)				Logged Cuttings from 0-6'
12	4	5	Red SILT, little Clay, trace fine Sand, micaceous, (MH)			352.96	Medium Dense
10	6	10	Red fine SAND, little Silt, trace Clay, micaceous, (SM)			347.96	Medium Dense
9	4						Medium Dense
12	5						Medium Dense
9	3	15				342.96	Medium Dense
10	5		Tan to Brown fine SAND, little Silt, trace Clay, micaceous, (SM)				Medium Dense
14	6						Medium Dense
16	7	20				337.96	Medium Dense
19	10						Medium Dense
17	10	25				332.96	Medium Dense
22	12						Very Dense
39	17	30	Red/Brown fine SAND, some Silt, iron and biotite bands, micaceous (SM)			327.96	Very Dense
41	22						Very Dense
>50	50/4"		Gray fine SAND and Silt; SAPROLITE, (SM)				
			Auger Refusal at 34'				

BORING/WELL LOG

Boring/Well ID: **DAA-14pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726467.15	Sampling Method:	Split Spoon
Start Date:	03/05/19	Easting:	11591831.94	Well Material:	2" Schedule 40 PVC
Completion Date:	03/05/19	Ground Elevation:	380.13	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	42'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	381.44	Seal:	Bentonite Pellets/Hydrated

Samp ID	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
		5				375.13	
15	3		Red SILT, some Clay, trace fine Sand (ML)				Stiff
	6						
	9						
	12						
14	4						Stiff
	5						
	9						
	10						
15	3	10				370.13	Stiff
	6						
	9						
	10						
8	3		Red SILT and fine Sand, trace Clay, white quartzite gravel lenses, (SM)				Medium Stiff
	4						
	4						
	6						
	3						
8	3	15				365.13	Medium Stiff
	5						
	6						
	3						
7	3						Loose
	4						
	4						
8	3		Red SILT and fine Sand, trace Clay, white quartzite gravel lenses, (SM)				Loose
	4						
	4						
	6						
	3	20				360.13	Loose
	4						
9	5						Loose
	5						
	2						
9	4						Loose
	5						
	5						
11	4	25	Lite tan fine SAND, little Silt, biotite bands, white quartzite sand lenses, micaceous (SM)			355.13	Medium Dense
	6						
	8						
	3						
7	3						Loose
	4						
	7						
	4						
10	4						Loose
	6						
	12	30				350.13	
	5		Lite tan fine SAND, little Silt, biotite bands, white quartzite sand lenses, micaceous (SM)				
18	7						Medium Dense
	11						
	11						
	4						
13	6		Lite tan fine SAND, little Silt, biotite bands, white quartzite sand lenses, micaceous (SM)				
	7						
	8						
	5						Medium Dense
	7						



Boring/Well ID: **DAA-14pz**

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Samp ID	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
28	10		Lite tan fine SAND, little Silt, biotite bands, white quartzite sand lenses, micaceous (SM)			340.13	Medium Dense
14	12						Medium Dense
	6						
	11		Lite tan fine SAND, little Silt, biotite bands, white quartzite sand lenses, micaceous, SAPROLITE, (SM)			340.13	Medium Dense
	12						
	8						
	6						
	16						
	32		Auger Refusal at 42'			340.13	Very Dense
>50	50/6"	40					
	23						
	45						
	50/4"						
			</				

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730413.59	Sampling Method:	Split Spoon
Start Date:	03/05/19	Easting:	11591080.07	Well Material:	2" Schedule 40 PVC
Completion Date:	03/05/19	Ground Elevation:	329.98	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	34'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	331.15	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5				324.98	
	Shelby Tube						
		10				319.98	
		15				314.98	
	Shelby Tube						
		20				309.98	
		25				304.98	
		30				299.98	
			Soil sampling and classification data available on well log for paired Deep well DAA-15pz-d				
			Auger Refusal at 34'				

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730411.63	Sampling Method:	Split Spoon
Start Date:	03/05/19	Easting:	11591070.98	Well Material:	2" Schedule 40 PVC
Completion Date:	03/05/19	Ground Elevation:	329.71	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	39'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	331.34	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
66	22 28 38 50/5"	5	Brown fine SAND, some Silt (SM)			324.71	
							Very Dense
>50	28 47 50/5"	10	Very light Tan fine SAND, trace Silt, iron bands, SAPROLITE (SM)			319.71	
							Very Dense
64	12 18 46 50/5"	15				314.71	
							Very Dense
>50	40 50/5"	20	Very light Tan fine SAND, trace Silt, white quartz gravel lenses, SAPROLITE (SM)			309.71	
							Very Dense
>50	50/3"	25				304.71	
							Very Dense
			Auger Refusal at 29'				
		30	Biotite Gneiss Rock Core Run 1: 29 to 34 feet Recovery: 59/60 inches = 98% RQD: 12/59 inches = 25%			299.71	



Rock Core

BORING/WELL LOG

Boring/Well ID: **DAA-15pz-d**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730411.63	Sampling Method:	Split Spoon
Start Date:	03/05/19	Easting:	11591070.98	Well Material:	2" Schedule 40 PVC
Completion Date:	03/05/19	Ground Elevation:	329.71	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	39'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	331.34	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
Rock Core			Biotite Gneiss Rock Core Run 2: 34 to 39 feet Recovery: 56.5/60 inches = 94% RDQ: 14/56.5 inches = 25%				
		40				289.71	
		45				284.71	
		50				279.71	
		55				274.71	
		60				269.71	
		65				264.71	

BORING/WELL LOG

Boring/Well ID: **DAA-16pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731369.62	Sampling Method:	Split Spoon
Start Date:	03/06/19	Easting:	11593538.41	Well Material:	2" Schedule 40 PVC
Completion Date:	03/06/19	Ground Elevation:	323.02	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	26'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	324.60	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Dark brown SILT, some Clay, trace fine Sand (MH)				Logged Cuttings from 0-6'
		5				318.02	
61	13		Brown fine SAND, some Silt, trace Clay (SM)				Very Dense
	26						
	35						Very Dense
	50/5"						
	21						
>50	37						
	50/3"						
		10				313.02	Very Dense
>50	41						
	50/3"						
							Very Dense
>50	50/6"						
		15				308.02	
			Light Tan fine SAND with lenses of Gray/Green Silt, mottling, SAPROLITE (SM)				
	50/4"						Very Dense
>50		20				303.02	
		25				298.02	
>50	50/3"		Auger Refusal at 26'				
		30				293.02	

BORING/WELL LOG

Boring/Well ID: **DAA-17sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731469.53	Sampling Method:	Split Spoon
Start Date:	03/06/19	Easting:	11593827.25	Well Material:	NA
Completion Date:	03/06/19	Ground Elevation:	332.69	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	22.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
		5	Red to brown SILT and Clay (MH)			327.69	
24	7 8 16						Medium Dense
	15 9		Light Tan very fine SAND, some Silt, dry (SM)				
23	11 12 16						Medium Dense
	8	10				322.69	
28	12 16		Green to gray fine SAND, little Silt, dry (SM)				Medium Dense
	19 11						
40	16 24						Medium Dense
	24 12		Light Tan very fine SAND, some Silt, dry, SAPROLITE (SM)				
59	22 37 50/5"	15				317.69	Very Dense
			Red to brown fine SAND, some SILT, biotite bands, SAPROLITE (SM)				
		20				312.69	
76	19 39 37 41						Very Dense
			Auger Refusal at 22.5'				
		25				307.69	
		30				302.69	

BORING/WELL LOG

Boring/Well ID: **DAA-18pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730329.89	Sampling Method:	Split Spoon
Start Date:	03/07/19	Easting:	11594565.79	Well Material:	2" Schedule 40 PVC
Completion Date:	03/07/19	Ground Elevation:	342.12	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	27'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	343.46	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT and Clay, trace fine Sand (MH)				Logged Cuttings from 0-6'
		5	Brown fine SAND, some Silt, trace Clay, white quartz gravel lenses (SM)			337.12	
4	3						Loose
	2						
	2						
4	2						Loose
	2						
	2	10				332.12	
6	3		Red/Brown fine SAND, little Silt, biotite and iron bands, micaceous (SM)				Loose
	3						
9	4						Medium Dense
	4						
	5						
	4	15				327.12	
							Medium Dense
23	17		Brown fine SAND, some Silt, trace Clay, white quartz gravel lenses (SM)				
	11						
	12						
	16						
25	7						Dense
	11						
	14	20				322.12	
	17						
53	8						Very Dense
	18						
	35						
	50						
		25	Brown/Gray very fine SAND and Silt, white quartz sand lenses, SAPROLITE (SM)			317.12	
>50	18						Very Dense
	50/2"						
			Auger Refusal at 27'				
		30				312.12	

BORING/WELL LOG

Boring/Well ID: **DAA-19pz-s**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3732042.79	Sampling Method:	Split Spoon
Start Date:	03/07/19	Easting:	11594480.40	Well Material:	2" Schedule 40 PVC
Completion Date:	03/07/19	Ground Elevation:	325.34	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	21.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	325.94	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (MH)				Logged Cuttings from 0-6'
		5				320.34	
14	7		Brown/Gray/Green fine SAND, little Silt, trace Clay, Mottled (SM)				Medium Dense
	6						
	8						
	12						
	8						Dense
34	10						
	24						
	42						
	16	10				315.34	Very Dense
>50	45		Light Tan very fine SAND, little Silt, loose, dry, SAPROLITE (SM)				
	50/4"						
		15				310.34	Very Dense
>50	50/4"						
		20				305.34	Very Dense
>50	50/2"		Auger Refusal at 21.5'				
		25				300.34	Very Dense
		30				295.34	

BORING/WELL LOG

Boring/Well ID: **DAA-19pz-d**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3732039.94	Sampling Method:	Split Spoon
Start Date:	03/11/19	Easting:	11594488.33	Well Material:	2" Schedule 40 PVC
Completion Date:	03/11/19	Ground Elevation:	325.18	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	33'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	327.09	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5				320.18	
		10				315.18	
		15				310.18	
		20				305.18	
		23	Auger Refusal at 23'				
		25	Biotite Gneiss Rock Core Run 1: 23 to 28 feet Recovery: 58.5/60 inches = 97% RQD: 23/58 inches = 39%			300.18	
		30	Biotite Gneiss Rock Core Run 2: 28 to 33 feet Recovery: 57.5/60 inches = 96% RDQ: 37/57.5 inches = 65%			295.18	
							Sand caved into core hole from 29 to 33'

Soil sampling and classification data available on well log for paired Shallow well DAA-19pz-s

Auger Refusal at 23'

Biotite Gneiss Rock Core
Run 1: 23 to 28 feet
Recovery: 58.5/60 inches = 97%
RQD: 23/58 inches = 39%

Biotite Gneiss Rock Core
Run 2: 28 to 33 feet
Recovery: 57.5/60 inches = 96%
RDQ: 37/57.5 inches = 65%

Sand caved into core hole from 29 to 33'

Rock Core

BORING/WELL LOG

Boring/Well ID: **DAA-20pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3732042.79	Sampling Method:	Split Spoon
Start Date:	03/11/19	Easting:	11594480.40	Well Material:	2" Schedule 40 PVC
Completion Date:	03/11/19	Ground Elevation:	312.39	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	34'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	313.62	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (MH)				Logged Cuttings from 0-6'
		5				307.39	
30	7 13 17 18 10		Red very fine SAND, some Silt, trace Clay (SM)				Dense
35	18 17 26	10				302.39	Dense
47	14 19 28 23 9		Gray/Green very fine SAND, little Silt, white quartz course sand lenses (SM)				Vey Dense
52	20 32 42 16						Very Dense
39	18 21 26 18 40	15				297.39	Very Dense
>50	50/5"						Very Dense
>50	37 50/6"		Light Tan very fine SAND, little Silt, white quartz course sand lenses, loose, dry SAPROLITE (SM)				Very Dense
>50	50/6"	20				292.39	Very Dense
>50	20 34 50/4"	25	Red/Brown fine SAND, some Silt, loose, dry, SAPROLITE (SM)			287.39	Very Dense
>50	50/1"	30				282.39	
			Auger Refusal at 34				

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733279.40	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11594045.62	Well Material:	NA
Completion Date:	03/12/19	Ground Elevation:	315.47	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red Brown SILT and Clay (MH)				
							Logged Cuttings from 0-6'
		5	Red fine SAND, some Silt, little Clay with gray medium sand lenses (SM)			310.47	
22	6 9 13 18 13						Medium Dense
29	17 12 16						Medium Dense
	6	10	Brown fine SAND, some Silt, trace Clay (SM)			305.47	
23	11 12 19						Medium Dense
28	7 12 16						Medium Dense
	25 13		Gray to white fine SAND, little Silt (SM)				
57	22 35	15				300.47	Very Dense
>50	50/6" 41 50/4"						Very Dense
		20				295.47	
>50	32 50/2"						Very Dense
		25	Light brown fine SAND and Silt, SAPROLITE (SM)			290.47	
		30				285.47	
>50	25 50/5"						Very Dense

BORING/WELL LOG

Boring/Well ID: **DAA-21sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733279.40	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11594045.62	Well Material:	NA
Completion Date:	03/12/19	Ground Elevation:	315.47	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	45 50/4"		Light brown fine SAND and Silt, trace white quartzite gravel, <i>SAPROLITE (SM)</i>				Very Dense
>50	50/5"	40	Gray fine SAND, little Silt, dry, <i>SAPROLITE (SM)</i>			275.47	Very Dense
>50	50/2"	45	Gray fine SAND, little Silt, dry, <i>SAPROLITE (SM)</i>			270.47	Very Dense
			Auger Refusal at 47'				
		50				265.47	
		55				260.47	
		60				255.47	
		65				250.47	

BORING/WELL LOG

Boring/Well ID: **DAA-22pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733377.87	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11594485.30	Well Material:	2" Schedule 40 PVC
Completion Date:	03/12/19	Ground Elevation:	323.33	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	55'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	324.70	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand, elastic (MH)				Logged Cuttings from 0-6'
6	2334	5	Tan SILT, some fine Sand, trace Clay, moist (SM)			318.33	Medium Stiff
5	2233	10				313.33	Loose
5	2233		Reddish brown fine SAND, little Silt, micaceous, loose (SM)				Loose
7	3333						Loose
6	3333	15				308.33	Loose
6	3333						Loose
11	5555	20	Gray/Green fine SAND, some Silt, micaceous, white quartz sand lenses, loose (SM)			303.33	Medium Dense
12	6666						Medium Dense
>50	30 50/5"						Very Dense
>50	50/6"	25				298.33	Very Dense
>50	18 39 50/4"	30	Brown fine SAND, some Silt, trace white quartz gravel, micaceous, SAPROLITE (SM)			293.33	Very Dense

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733377.87	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11594485.30	Well Material:	2" Schedule 40 PVC
Completion Date:	03/12/19	Ground Elevation:	323.33	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	55'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	324.70	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	39 50/6"						Very Dense
>50	50/3"	40				283.33	
		45	Brown fine SAND, little Silt, trace white quartz gravel, micaceous, <i>SAPROLITE (SM)</i>			278.33	
>50	50/1"	50				273.33	No Sample Recovery
		55	No Auger Refusal, boring depth terminated at 55'			268.33	
		60				263.33	
		65				258.33	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733647.76	Sampling Method:	Split Spoon
Start Date:	03/13/19	Easting:	11595024.84	Well Material:	2" Schedule 40 PVC
Completion Date:	03/13/19	Ground Elevation:	318.63	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	33'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	320.61	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
							Logged Cuttings from 0-6'
6	23	5	Red SILT and Clay, little fine Sand (ML)			313.63	
5	22		Red fine SAND, some Silt, trace Clay, white Quartz sand lenses, black biotite bands (SM)				Loose
	2						Loose
	Shelby Tube	10				308.63	
5	3		Reddish brown fine SAND, some Silt, trace Clay, micaceous (SM)				Loose
5	2						
	3	15	Dark gray fine SAND, little Silt (SM)			303.63	Loose
	3						
	Shelby Tube						
20	5		Red fine SAND, some Silt, trace Clay (SM)				Medium Dense
	15						
	18	20				298.63	
	12		White fine SAND, trace Silt (SM)				Dense
47	20						
	27						
	35						
	Shelby Tube						
30	8	25	White fine SAND, trace Silt (SM)			293.63	Medium Dense
	10						
	20						
	31						
	24						
>50	29						Very Dense
	50/6"						
23	15		Gray fine SAND, little Silt, trace Clay, micaceous, SAPROLITE (SM)				Medium Dense
	12						
	11	30				288.63	
	15						
	Shelby Tube						
>50	41		Auger Refusal at 33'				
	50/3"						

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733658.36	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11595026.15	Well Material:	2" Schedule 40 PVC
Completion Date:	03/13/19	Ground Elevation:	317.94	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	318.67	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5				312.94	
		10				307.94	
		15				302.94	
		20				297.94	
		25				292.94	
		30				287.94	
			Soil sampling and classification data available on well log for paired Shallow well DAA-23pz-s				

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733658.36	Sampling Method:	Split Spoon
Start Date:	03/12/19	Easting:	11595026.15	Well Material:	2" Schedule 40 PVC
Completion Date:	03/13/19	Ground Elevation:	317.94	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	318.67	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Auger Refusal at 37"				
		40	Bitotite Gneiss Rock Core Run 1: 37 to 42 feet Recovery: 54.5/60 inches = 90% RQD: 32.5/60 inches = 54%			277.94	
		45	Biotite Gneiss Rock Core Run 1: 42 to 47 feet Recovery: 58/60 inches = 96% RQD: 50.5/58 inches = 87%			272.94	
		50				267.94	
		55				262.94	
		60				257.94	
		65				252.94	

BORING/WELL LOG

Boring/Well ID: **DAA-24pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3734520.89	Sampling Method:	Split Spoon
Start Date:	03/13/19	Easting:	11593898.96	Well Material:	2" Schedule 40 PVC
Completion Date:	03/13/19	Ground Elevation:	289.87	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	23'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	291.19	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				Logged Cuttings from 0-6'
		5				284.87	
5	2		Red fine SAND, some Silt, trace Clay, white quartz sand lenses, micaceous (SM)				Loose
	2						
	3						
8	3						Loose
	3						
	5						
	6	10	Tan fine SAND, some Silt (SM)			279.87	
10	5						Loose
	5						
	4		Red fine SAND, some Silt, trace Clay, white quartz sand lenses, micaceous (SM)				Loose
8	4						
	4						
	6						
11	7	15	Tan fine SAND, some Silt (SM)			274.87	Medium Dense
	5						
	8						
25	8		Red fine SAND, some Silt, trace Clay, white quartz sand lenses, micaceous (SM)				Medium Dense
	17						
	50/3"						Dense
	50/3"		Tan fine SAND, some Silt, micaceous, SAPROLITE (SM)				
>50		20				269.87	
			Auger Refusal at 23'				
		25				264.87	
		30				259.87	





Boring/Well ID: **DAA-25pz-s**

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N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5				321.38	
		10				316.38	
		15				311.38	
	Shelby Tube	20				306.38	
		25				301.38	
		30				296.38	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733647.76	Sampling Method:	Split Spoon
Start Date:	03/14/19	Easting:	11595024.84	Well Material:	2" Schedule 40 PVC
Completion Date:	03/14/19	Ground Elevation:	326.38	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	37'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	328.45	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Auger Refusal at 37"				
		40				286.38	
		45				281.38	
		50				276.38	
		55				271.38	
		60				266.38	
		65				261.38	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730467.21	Sampling Method:	Split Spoon
Start Date:	03/14/19	Easting:	11593049.11	Well Material:	2" Schedule 40 PVC
Completion Date:	03/14/19	Ground Elevation:	326.58	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	327.70	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (MH)				Logged Cuttings from 0-6'
6	2	5				321.58	
5	2		Red/Brown SILT and Sand, trace Clay, micaceous (SM)				Loose
4	2	10				316.58	Loose
5	3						Loose
9	3	15				311.58	Loose
11	5		Brown fine SAND, some Silt, trace Clay, micaceous (SM)				Loose
12	6						Medium Dense
15	7	20				306.58	Medium Dense
45	5						Medium Dense
>50	6	25	Brown med to fine SAND, some Silt, trace Clay, gray and white quartz coarse sand lenses, micaceous, SAPROLITE (SM)			301.58	Very Dense
		30	Gray med to fine SAND, some Silt, trace gravel, micaceous, SAPROLITE (SM)			296.58	Very Dense

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730467.21	Sampling Method:	Split Spoon
Start Date:	03/14/19	Easting:	11593049.11	Well Material:	2" Schedule 40 PVC
Completion Date:	03/14/19	Ground Elevation:	326.58	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	47'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	327.70	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	50/5"						
			Auger Refusal at 37"				
		40	Biotite Gneiss Rock Core Run 1: 37 to 42 feet Recovery: 58/60 inches = 96% RQD: 41/58 inches = 70%			286.58	
		45	Biotite Gneiss Rock Core Run 1: 42 to 47 feet Recovery: 58.5/60 inches = 97% RQD: 33.5/58.5 inches = 57%			281.58	
		50				276.58	
		55				271.58	
		60				266.58	
		65				261.58	

Rock Core

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731202.27	Sampling Method:	Split Spoon
Start Date:	03/27/19	Easting:	11591698.15	Well Material:	2" Schedule 40 PVC
Completion Date:	03/27/19	Ground Elevation:	304.20	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	48'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	305.08	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
5	3		Red SILT, some Clay (MH)				Soft
	2						
	3						
	3						
	4		Reddish brown SILT, some Clay, elastic (MH)				
7	3						Medium Stiff
	4						
	5						
	3						
11	4	5				299.20	Medium Stiff
	7						
	8						
	3						
12	5		Light brown SILT and Clay, elastic (MH)				Stiff
	7						
	10						
	4						
16	6						Stiff
	10						
	12						
	4	10	Light brown SILT, some Clay, little fine Sand mottling, elastic (MH)			294.20	
18	8						Very Stiff
	10						
	12						
	5						
17	7						Very Stiff
	10						
	9						
	4						
20	7	15				289.20	Very Stiff
	13						
	10						
	4						
11	5						Stiff
	6						
	9						
	3						
9	4						Medium Stiff
	5						
	8						
	wh	20				284.20	
6	3						Medium Stiff
	3						
	4						
4	wh						Soft
	2						
	2						
	4						
	wh						
4	2	25				279.20	Soft
	2						
	3		Light brown SILT, some Clay, trace fine Sand, mottling, elastic (MH)				
	wh						
9	6						Medium Stiff
	3						
	13						
	wh						
13	7						Stiff
	6						
	8						
	wh	30				274.20	
6	2						Medium Stiff
	4						
	6						
	3						
17	7						Stiff
	10						
	23						
	3						
	8		Light brown fine SAND, some Silt, trace Clay, (SM)				

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731202.27	Sampling Method:	Split Spoon
Start Date:	03/27/19	Easting:	11591698.15	Well Material:	2" Schedule 40 PVC
Completion Date:	03/27/19	Ground Elevation:	304.20	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	48'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	305.08	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
15	14 15 6 6 9 15 4 7						Medium Dense
17	10 16 5 8	40	Light brown fine SAND, some Silt, little Sand, trace Clay, (SM)			264.20	Medium Dense
18	10 15 7						Medium Dense
30	12 18 25 12						Dense
57	25 32 42 50/2	45	Light brown fine SAND, little Silt, SAPROLITE (SM)			259.20	Very Dense
>50			Auger Refusal at 48'				
		50				254.20	
		55				249.20	
		60				244.20	
		65				239.20	



Boring/Well ID: **DAA-27sb**

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N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Brown SILT, some Clay, trace fine Sand (MH)				
32	6 12 20		Brown to dark gray fine SAND, some Silt, trace Clay (SM)				Medium Dense
>50	60/4" 50/6"						
		5				326.70	
>50	24 50/3"						Very Dense
48	24 25 23						Very Dense
	39 18	10				321.70	
59	22 37						Very Dense
	50/4" 50/3"		Light Tan very fine SAND, little Silt, trace white quartzite gravel, dry, <i>SAPROLITE</i> (SM)				
30	14 12 8	15				316.70	Medium Dense
>50	14 11						Very Dense
	50/4"						
>50	50/5"						
	50/3"	20				311.70	
>50			Auger Refusal at 21.5'				
		25				306.70	
		30				301.70	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730566.92	Sampling Method:	Split Spoon
Start Date:	03/28/19	Easting:	11591349.73	Well Material:	NA
Completion Date:	03/28/19	Ground Elevation:	320.28	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	44'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
6	2 2 4 7 3 3		Red to brown SAND, some Silt, little Clay (SM)				Medium Stiff
12	6 6 10 6 6 7 10 5	5				315.28	Stiff
13	14 30 23 7	10				310.28	Dense
23	12 11 28 7 42 50/6"		Light Tan very fine SAND and Silt, (SM)				Medium Dense
>50							Very Dense
79	27 42 37 28 11 24 31 21 18 50/0"	15				305.28	Very Dense
55							Very Dense
>50			Brown to red fine SAND, some Silt, trace Clay, white quartzite sand lenses, micaceous, SAPROLITE, (SM)			300.28	Very Dense
65	20 24 41 38 36 50/5"	20					Very Dense
>50							Very Dense
>50	29 50/4"	25				295.28	Very Dense
>50	28 50/6"						Very Dense
>50	50/6"						
61	28 25 36 50/6" 50/5"	30	Red fine SAND, some Silt, iron and biotite bands, SAPROLITE, (SM)			290.28	Very Dense
>50	50/6"						

BORING/WELL LOG

Boring/Well ID: **DAA-28sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730566.92	Sampling Method:	Split Spoon
Start Date:	03/28/19	Easting:	11591349.73	Well Material:	NA
Completion Date:	03/28/19	Ground Elevation:	320.28	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	44'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated





N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	26 50/3"	40	Red fine SAND, some Silt, iron and biotite bands, white quartzite gravel lenses, <i>SAPROLITE</i> , Wet (SM)			280.28	Very Dense
		45	Auger Refusal at 44'			275.28	
		50				270.28	
		55				265.28	
		60				260.28	
		65				255.28	

BORING/WELL LOG

Boring/Well ID: **DAA-29pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729450.80	Sampling Method:	Split Spoon
Start Date:	03/28/19	Easting:	11591602.94	Well Material:	2" Schedule 40 PVC
Completion Date:	03/28/19	Ground Elevation:	347.84	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	34.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	349.41	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks		
7	2 3 4 7 2		Brown fine SAND, some Clay, little Silt (SC)				Medium Stiff		
10	4 6 9 4	5							
17	6 11 18 6							342.84	Loose
30	12 18 25 4	10						337.84	Medium Dense
31	12 19 23 11							Dense	
41	23 18 27 7		Brown fine SAND, some Silt, little Clay, trace gravel (SM)			Dense			
45	14 31 28 19	15					332.84	Dense	
59	32 27 31 10						Very Dense		
>50	22 50/6"						Very Dense		
		20					327.84	Very Dense	
>50	15 32 50/4"						Very Dense		
>50	13 31 50/5"						Light Tan very fine SAND, some Silt, trace gravel, SAPROLITE (SM)	Very Dense	
67	15 27 40 50/6"	25					322.84	Very Dense	
>50	26 36 50/4"						Red/Brown fine SAND, some Silt, little Clay SAPROLITE (SM)	Very Dense	
>50	20 29 50/4"						Very Dense		
		30	317.84						
>50	50/5"		Dark Gray fine SAND, little Silt, SAPROLITE (SM)						
			Auger Refusal at 34.5'						

BORING/WELL LOG

Boring/Well ID: **DAA-30sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729480.24	Sampling Method:	Split Spoon
Start Date:	03/28/19	Easting:	11590921.73	Well Material:	NA
Completion Date:	03/28/19	Ground Elevation:	339.93	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	31'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, little Clay, trace fine Sand (ML)				
>50	50/5"						Very Dense
>50	50/2"	5				334.93	Very Dense
>50	50/3"						Very Dense
>50	15 30 50/3"						Very Dense
>50	50/6"	10				329.93	Very Dense
>50	50/3"		Light Tan fine SAND and Silt, trace white quartzite gravel, SAPROLITE (SM)				Very Dense
>50	41 50/4"	15				324.93	Very Dense
>50	50/5"	20				319.93	Very Dense
>50	44 50/4"	25	Dark gray fine SAND and Silt, SAPROLITE (SM)			314.93	Very Dense
>50	50/3"	30				309.93	Very Dense
			Auger Refusal at 31'				

BORING/WELL LOG

Boring/Well ID: **DAA-31pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729450.80	Sampling Method:	Split Spoon
Start Date:	03/29/19	Easting:	11591602.94	Well Material:	2" Schedule 40 PVC
Completion Date:	03/29/19	Ground Elevation:	348.57	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	33.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	349.92	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	25 32 50/6"		Red SILT, some Sand, trace fine Sand (SM)				Very Dense
59	15 27 32 50/6"	5				343.57	Very Dense
54	14 19 35 25 9		Light Tan fine SAND, some Silt (SM)				Very Dense
37	17 20 34 19	10				338.57	Dense
>50	29 50/6"						Very Dense
57	20 31 26 21 8						Very Dense
22	9 13 12 12 15	15	Tan fine SAND, some Silt, trace Clay, biotite and iron bands, white quartz sand lenses (SM)			333.57	Medium Dense
42	27 36 10						Dense
34	18 16 20 18	20				328.57	Dense
49	31 18 27 50/6"						Very Dense
>50							Very Dense
>50	50/1"	25				323.57	Very Dense
>50	50/2"						Very Dense
>50		30	Brown Silt, some SAND, micaceous, SAPROLITE, (SM)				
						318.57	
			Auger Refusal at 33.5'				

BORING/WELL LOG

Boring/Well ID: **DAA-32sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3728036.55	Sampling Method:	Split Spoon
Start Date:	03/29/19	Easting:	11591011.48	Well Material:	NA
Completion Date:	03/29/19	Ground Elevation:	349.82	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	31'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
22	6 7 15 29 14		Red SILT and Clay, trace fine Sand (ML)				Very Stiff
>50	22 50/5"	5				344.82	Very Dense
>50	50/4"						Very Dense
>50	50/3"		Tan very fine SAND and Silt, dry, SAPROLITE, (SM)				Very Dense
>50	50/4"	10				339.82	Very Dense
>50	50/3"						Very Dense
>50	50/4"						Very Dense
>50	50/3"	15				334.82	Very Dense
>50	50/3"		Gray SILT, some fine Sand, SAPROLITE (SM)				Very Dense
>50	50/2"						Very Dense
>50	50/2"	20				329.82	Very Dense
>50	50/4"	25	Light Tan SILT, some fine Sand, SAPROLITE, (SM)			324.82	Very Dense
>50	50/1"	30				319.82	Very Dense
			Auger Refusal at 31'				

BORING/WELL LOG

Boring/Well ID: **DAA-33sb**

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Project:	Green Ridge Recycling		Boring/Well Area:	West Area		Drilling Rig Type:	Track Rig CME 45	
Project #:	18020117-030201		Logged By:	D. Coakley		Drilling Method:	3.25" Hollow Stem Auger	
Location:	Cumberland County, VA		Northing:	3727617.39		Sampling Method:	Split Spoon	
Start Date:	04/02/19		Easting:	11591448.65		Well Material:	NA	
Completion Date:	04/02/19		Ground Elevation:	348.20		Screen Size:	NA	
Contractor:	Blue Ridge Drilling		Total Depth:	17'		Filter Pack:	NA	
Driller:	James Jones		TOC Elevation:	NA		Seal:	Bentonite Pellets/Hydrated	
N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks	
7	4		Red fine SAND, little Silt, little Clay, micaceous (SM)				Medium Stiff	
	3							
	4							
	5							
	3							
6	2	5	Gray fine SAND, some Clay, little Silt (SM)			343.20	Medium Stiff	
	4							
	4							
6	2						Loose	
	3							
	3							
	5							
9	3						Loose	
	4							
	5							
	7							
	2	10				338.20	Loose	
10	4							
	6							
	9							
30	5						Medium Dense	
	12		Brown fine SAND, some Silt, dry, SAPROLITE, (SM)					
	18							
	50/5"		Auger Refusal at 17'					
	50/6"							
>50		15				333.20	Very Dense	
	50/0"		Auger Refusal at 17'					
>50								
		20	Auger Refusal at 17'			328.20		
		25	Auger Refusal at 17'			323.20		
			Auger Refusal at 17'					
		30	Auger Refusal at 17'			318.20		

BORING/WELL LOG

Boring/Well ID: **DAA-34pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3728241.05	Sampling Method:	Split Spoon
Start Date:	04/02/19	Easting:	11592007.95	Well Material:	2" Schedule 40 PVC
Completion Date:	04/02/19	Ground Elevation:	354.70	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	39.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	355.38	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
8	33		Red SILT, some Clay, trace fine Sand (ML)				Loose
7	34	5	Red SILT, some Clay, little Sand, micaceous (ML)			349.70	Loose
9	33						Loose
9	33	10				344.70	Loose
7	33						Loose
8	33						Loose
7	33	15				339.70	Loose
9	34		Brown to Red SILT, some fine Sand, trace Clay, micaceous, white quartz sand lenses (SM)				Loose
10	35						Loose
13	35	20				334.70	Medium Dense
14	37						Medium Dense
	37						
	10	25				329.70	
>50	22						Very Dense
>50	34						Very Dense
	50/5"						
>50	32						Very Dense
	50/6"						
>50	50/5"	30	Brown very fine SAND, some Silt, micaceous, SAPROLITE (SM)			324.70	Very Dense
>50	50/2"						

BORING/WELL LOG

Boring/Well ID: **DAA-34pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3728241.05	Sampling Method:	Split Spoon
Start Date:	04/02/19	Easting:	11592007.95	Well Material:	2" Schedule 40 PVC
Completion Date:	04/02/19	Ground Elevation:	354.70	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	39.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	355.38	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
	50/5"		Brown very fine SAND, some Silt, micaceous, SAPROLITE (SM)				
			Auger Refusal at 39.5'				
		40				314.70	
		45				309.70	
		50				304.70	
		55				299.70	
		60				294.70	
		65				289.70	

BORING/WELL LOG

Boring/Well ID: **DAA-35pz**

Page 1 of 2

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727576.32	Sampling Method:	Split Spoon
Start Date:	04/03/19	Easting:	11592108.08	Well Material:	2" Schedule 40 PVC
Completion Date:	04/03/19	Ground Elevation:	365.58	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	38'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	367.36	Seal:	Bentonite Pellets/Hydrated

Samp ID	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
7	13		Red CLAY, little Silt (ML)				Loose
7	4						
7	3						
7	4						
7	5	5				360.58	Loose
5	2						Loose
5	3						Loose
4	2						Loose
4	2		Red SILT, some Clay, little fine Sand, micaceous (SM)				Loose
5	2	10				355.58	Loose
5	3						Loose
	3						
	Shelby Tube						
5	2	15				350.58	Loose
8	3						Loose
8	4						Loose
7	3						Loose
7	4						Loose
10	5	20	Light brown to tan fine SAND, some Silt, trace Clay, white quartz gravel lenses, micaceous (SM)			345.58	Loose
13	5						Medium Dense
13	6						
	7						
	Shelby Tube	25				340.58	
47	8						Dense
43	19						Dense
43	28						Dense
43	15						Dense
43	8						Dense
43	20						Dense
43	23	30	Gray to Light brown fine SAND, some Silt, trace gravel, micaceous, (SM)			335.58	Dense
43	8						Dense
43	18						Dense
43	25						Dense
43	40						Dense

BORING/WELL LOG

Boring/Well ID: **DAA-35pz**

Page 2 of 2

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727576.32	Sampling Method:	Split Spoon
Start Date:	04/03/19	Easting:	11592108.08	Well Material:	2" Schedule 40 PVC
Completion Date:	04/03/19	Ground Elevation:	365.58	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	38'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	367.36	Seal:	Bentonite Pellets/Hydrated

Samp ID	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	35 50/6"		Light Tan very fine SAND, little Silt, micaceous, SAPROLITE (SM)				Very Dense
			Auger Refusal at 38'				
		40				325.58	
		45				320.58	
		50				315.58	
		55				310.58	
		60				305.58	
		65				300.58	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729104.75	Sampling Method:	Split Spoon
Start Date:	04/03/19	Easting:	11593620.95	Well Material:	2" Schedule 40 PVC
Completion Date:	04/03/19	Ground Elevation:	340.15	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	45'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	340.83	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red/brown SILT, little Clay, trace fine Sand (ML)				
7	4						Loose
	3						
	4						
	6						
	2		Red to Tan SILT, little Sand, trace Clay (SM)				
5	2	5				335.15	Loose
	3						
	2						
5	3						Loose
	4						
	4		Tan SAND and Silt, trace Clay (SM)				
7	3						Loose
	4						
	4	10	Tan/Red/Gray SAND, some Silt, little Clay, mottling; moist (SM)			330.15	
4	2						Loose
	1						
	3						
	3						
6	2		Red SILT, little Clay, gray sand lenses; moist; (SM)				Loose
	3						
	5						
	3						
9	3	15				325.15	Loose
	6						
	7						
	4						
15	6		Tan SILT, some fine Sand, little Clay (SM)				Medium Dense
	9						
	9						
17	6						Medium Dense
	9						
	8						
	10	20				320.15	
18	5						Medium Dense
	7						
	11						
	14						
20	7						Medium Dense
	10						
	10						
	22						
32	15	25				315.15	Dense
	15						
	17						
	28						
23	10		Tan to brown fine SAND and Silt, trace Clay (SM)				Medium Dense
	11						
	12						
	17						
		30				310.15	
21	8						Medium Dense
	10						
	11						
	16						

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729104.75	Sampling Method:	Split Spoon
Start Date:	04/03/19	Easting:	11593620.95	Well Material:	2" Schedule 40 PVC
Completion Date:	04/03/19	Ground Elevation:	340.15	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	45'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	340.83	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
30	7 13 17 24						Dense
57	22 28 29 50/6"	40	Brown fine SAND, little Silt, white/pink quartzite gravel lenses, <i>SAPROLITE (SM)</i>			300.15	Very Dense
		45	Auger Refusal at 45"			295.15	
		50				290.15	
		55				285.15	
		60				280.15	
		65				275.15	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729474.02	Sampling Method:	Split Spoon
Start Date:	04/04/19	Easting:	11594007.15	Well Material:	NA
Completion Date:	04/04/19	Ground Elevation:	357.48	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	47.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT and Clay (ML)				
14	3						Medium Dense
	6						
	8						
	10						
10	3	5	Red SILT and fine Sand, trace Clay, micaceous, dry (SM)			352.48	Loose
	5						
	7						
8	3						Loose
	5						
	5						
		10				347.48	
10	5						Loose
	5						
	3						
6	2						Loose
	3						
	3						
6	2	15				342.48	Loose
	4						
	4						
7	3						Loose
	4						
	6						
13	5						Medium Dense
	8						
	9	20				337.48	
14	4		Light tan to brown SILT, some fine Sand, micaceous, white quartzite gravel lenses, (SM)				Medium Dense
	7						
	9						
	Shelby Tube						
	7						
17	8	25				332.48	Medium Dense
	9						
	12						
26	10						Medium Dense
	12						
	14						
	14						
	5						
35	13						Dense
	22						
	42						
	20	30				327.48	
	30						Very Dense
>50	50/6"						
64	20		Gray fine SAND, little Silt, dry, micaceous, SAPROLITE (SM)				Very Dense
	25						
	39						
	50/5"						
	14						
	50/5"						

BORING/WELL LOG

Boring/Well ID: **DAA-37sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729474.02	Sampling Method:	Split Spoon
Start Date:	04/04/19	Easting:	11594007.15	Well Material:	NA
Completion Date:	04/04/19	Ground Elevation:	357.48	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	47.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	40 60/4"						Very Dense
>50	40 50/3"	40	Gray fine SAND, little Silt, dry, micaceous, SAPROLITE (SM)			317.48	Very Dense
>50	45 50/2"	45				312.48	Very Dense
			Auger Refusal at 47.5'				
		50				307.48	
		55				302.48	
		60				297.48	
		65				292.48	

BORING/WELL LOG

Boring/Well ID: **DAA-38sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3734294.95	Sampling Method:	Split Spoon
Start Date:	04/04/19	Easting:	11594503.05	Well Material:	NA
Completion Date:	04/04/19	Ground Elevation:	307.43	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	19.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated




N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT and Clay (ML)				
9	3						Loose
	3						
	6						
	9						
	3						
8	4	5	Red SILT and fine Sand, micaceous (SM)			302.43	Loose
	4						
	6						Loose
	3						
6	3						
	5						
	5						
15	10						Medium Dense
	11						
	5	10				297.43	
13	6						Medium Dense
	7						
	8						
18	5		Very light Tan fine SAND and Silt, micaceous, dry, (SM)				Medium Dense
	7						
	11						
	9						
	Shelby Tube	15				292.43	
	7						
12	5						Medium Dense
	7						
	10						
	6						
>50	50/6"		Auger Refusal at 19.5'				Very Dense
		20				287.43	
		25				282.43	
		30				277.43	

BORING/WELL LOG

Boring/Well ID: **DAA-39sb**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	3.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3733886.43	Sampling Method:	Split Spoon
Start Date:	04/04/19	Easting:	11594325.67	Well Material:	NA
Completion Date:	04/04/19	Ground Elevation:	315.21	Screen Size:	NA
Contractor:	Blue Ridge Drilling	Total Depth:	25.5'	Filter Pack:	NA
Driller:	James Jones	TOC Elevation:	NA	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	50/4"		Tan very fine SAND and Silt, <i>SAPROLITE</i> (SM)				Very Dense
>50	50/4"	5				310.21	Very Dense
>50	50/3"						Very Dense
>50	11 17 50/5"	10				305.21	Very Dense
43	14 21 22 23 15 35 34 30 10 13 18 27 24 31 50/5"	15				300.21	Dense
69	31 27 24 31 50/5"		Tan fine SAND, little Silt, white quartzite gravel lenses, <i>SAPROLITE</i> (SM)				Very Dense
43	19 21 22 22 17 20	20				295.21	Dense
56	23 33 39 18 31 38 50/5" 27 50/3"						Very Dense
69	18 31 38 50/5" 27 50/3"						Very Dense
>50	50/5" 27 50/3"	25				290.21	Very Dense
			Auger Refusal at 25.5'				
		30				285.21	

Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3732549.57	Sampling Method:	Split Spoon
Start Date:	04/05/19	Easting:	11594305.23	Well Material:	2" Schedule 40 PVC
Completion Date:	04/05/19	Ground Elevation:	325.93	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	29'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	327.50	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5	Red SILT and Clay (MH)			320.93	
		10	Red SILT, some fine Sand, little Clay (MH)			315.93	
		15	Brown fine SAND, some Silt (SM)			310.93	
		20				305.93	
		25	Brown fine SAND, some Silt, micaceous (SM)			300.93	
		30	Auger Refusal at 29'			295.93	

NOTE: Pouring rain, split spoons not collected due to safety concerns; Logged Cuttings and collected grab samples

BORING/WELL LOG

Boring/Well ID: **DAA-41pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	East Area	Drilling Rig Type:	Track Rig CME 45
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730877.23	Sampling Method:	Split Spoon
Start Date:	04/08/19	Easting:	11593612.69	Well Material:	2" Schedule 40 PVC
Completion Date:	04/08/19	Ground Elevation:	306.52	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	22.5'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	307.99	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
>50	18 38 50/6"		Brown fine SAND, some Silt (SM)				Very Dense
>50	43 50/4"	5	Light Tan fine SAND, some Silt, trace white quartz gravel, SAPROLITE (SM)			301.52	Very Dense
>50	50/5"						
>50	50/3"						
>50	50/5"	10				296.52	
>50	50/4"	15	Dark Brown fine SAND, little Silt, trace white quartz gravel, SAPROLITE (SM)			291.52	
>50	50/2"	20				286.52	
			Auger Refusal at 22.5'				
		25				281.52	
		30				276.52	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729104.75	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11593620.95	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	363.99	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	48'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	366.57	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				
		5				358.99	
		10				353.99	
		15	Red to brown SILT, little fine Sand, trace gravel (SM)			348.99	
		20				343.99	
		25				338.99	
		30	Light gray fine SAND, some Silt, trace white quartz gravel (SM)			333.99	

1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3729104.75	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11593620.95	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	363.99	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	48'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	366.57	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Light gray fine SAND, some Silt, trace white quartz gravel (SM)				
		40				323.99	Auger bit chattering noted, Increase in drilling down pressure required to advance depth;
		45	Dark Gray very fine SAND, some Silt, micaceous, wet SAPROLITE (SM)			318.99	
			Auger Refusal at 48"				
		50				313.99	
		55				308.99	
		60				303.99	
		65				298.99	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3732375.27	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11592068.47	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	309.00	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	15'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	309.32	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5	Light brown SILT, little fine Sand, dry (SM)			304.00	1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected
		10	Light Tan to gray fine SAND, some Silt, micaceous, dry (SM)			299.00	
		15	Brown to gray very fine SAND and Silt, micaceous, dry, SAPROLITE (SM)			294.00	Auger bit chattering noted, Increase in drilling down pressure required to advance depth;
			Auger Refusal at 15'				
		20				289.00	
		25				284.00	
		30				279.00	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727203.10	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11593948.53	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	379.96	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	45'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	382.98	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red to brown SILT and Clay, trace fine Sand, micaceous (ML)				
		5	Red SILT, trace white quartz gravel, (SM)			374.96	
			Dark brown SILT, trace fine Sand, micaceous, (SM)				
		10				369.96	
			Light Gray SILT, trace quartz gravel, micaceous, (SM)				
		15				364.96	
							1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected
		20				359.96	
		25				354.96	
							Auger bit chattering noted, Increase in drilling down pressure required to advance depth;
		30	Gray fine SAND, some Silt, trace white quartz gravel, micaceous, SAPROLITE (SM)			349.96	

BORING/WELL LOG

Boring/Well ID: **DAA-44pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727203.10	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11593948.53	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	379.96	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	45'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	382.98	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		40	Gray fine SAND, some Silt, trace white quartz gravel, micaceous, <i>SAPROLITE (SM)</i>			339.96	
		45	Auger Refusal at 45"			334.96	
		50				329.96	
		55				324.96	
		60				319.96	
		65				314.96	

BORING/WELL LOG

 Boring/Well ID: **DAA-45pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731594.25	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11590676.39	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	269.06	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	8'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	271.24	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected
		5	Light Tan to gray fine SAND, some Silt, micaceous, dry (SM)			264.06	
			Auger Refusal at 8'				
		10				259.06	
		15				254.06	
		20				249.06	
		25				244.06	
		30				239.06	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3727762.31	Sampling Method:	Logged Cuttings
Start Date:	05/20/19	Easting:	11593398.57	Well Material:	1" Schedule 40 PVC
Completion Date:	05/20/19	Ground Elevation:	360.77	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	35'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	364.16	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red SILT, some Clay, trace fine Sand (ML)				
		5	Red to brown SILT, some fine Sand, trace Clay, micaceous, (SM)			355.77	
		10				350.77	
		15	Brown fine SAND, some Silt, trace white quartz gravel, micaceous, (SM)			345.77	
		20				340.77	
		25	Light Gray SILT and fine Sand, micaceous, (SM)			335.77	
		30	Dark Gray very fine SAND, little Silt, micaceous, (SM)			330.77	
			Auger Refusal at 35'				

1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726637.56	Sampling Method:	Logged Cuttings
Start Date:	05/21/19	Easting:	11592845.76	Well Material:	1" Schedule 40 PVC
Completion Date:	05/21/19	Ground Elevation:	359.19	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	54'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	360.91	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
			Red to brown SILT, some Clay, trace fine Sand (ML)				
		5	Red to brown SILT, little fine Sand, trace gravel (SM)			354.19	
		10	Very light Tan to white fine SAND, little Silt (SM)			349.19	
		15	Light brown very fine SAND, trace gravel, micaceous (SM)			344.19	
		20				339.19	
		25				334.19	
		30	Light gray fine SAND, trace Silt, trace white quartz gravel (SM)			329.19	
							1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726637.56	Sampling Method:	Logged Cuttings
Start Date:	05/21/19	Easting:	11592845.76	Well Material:	1" Schedule 40 PVC
Completion Date:	05/21/19	Ground Elevation:	359.19	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	54'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	360.91	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		40	Gray very fine SAND, little Silt, micaceous, wet <i>SAPROLITE (SM)</i>			319.19	
		45				314.19	
		50	Dark Gray very fine SAND, little Silt, micaceous, wet <i>SAPROLITE (SM)</i>			309.19	Auger bit chattering noted, Increase in drilling down pressure required to advance depth;
		55	Auger Refusal at 54"			304.19	
		60				299.19	
		65				294.19	

Project:	Green Ridge Recycling	Boring/Well Area:	West Area	Drilling Rig Type:	Geoprobe 7822DT
Project #:	18020117-030201	Logged By:	D. Coakley	Drilling Method:	2.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3730575.48	Sampling Method:	Logged Cuttings from 0-6
Start Date:	05/21/19	Easting:	11589971.32	Well Material:	1" Schedule 40 PVC
Completion Date:	05/21/19	Ground Elevation:	315.50	Screen Size:	0.10 Slot
Contractor:	Jetco Inc.	Total Depth:	18'	Filter Pack:	#2 Sand
Driller:	Rory Ricks	TOC Elevation:	317.84	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
		5	Red SILT, some Clay, trace fine Sand (ML)			310.50	1" Piezometer installed for additional groundwater and bedrock (auger refusal) control data; drill cuttings logged; no samples collected
		10				305.50	
		15	Very light Tan fine SAND, trace Silt, white quartz gravel lenses, SAPROLITE (SM)			300.50	Auger bit chattering noted, Increase in drilling down pressure required to advance depth;
			Auger Refusal at 18'				
		20				295.50	
		25				290.50	
		30				285.50	

BORING/WELL LOG

 Boring/Well ID: **DAA-101pz**

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Project:	Green Ridge Recycling	Boring/Well Area:	North Area of Cell	Drilling Rig Type:	Track Rig CME 45
Project #:	2101370	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731134.94	Sampling Method:	Rock Core
Start Date:	11/30/21	Easting:	11590828.91	Well Material:	2" Schedule 40 PVC
Completion Date:	12/01/21	Ground Elevation:	310.55	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	55.0	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	312.55	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
	3 7 16 27 50/2"	5	Light to Dark Brown SILT and Sand, micaceous (SM)			305.55	Cuttings were logged in field; Blow counts from adjacent boring SB-9.
	30 50/5"		Dark Brown SILT, some Sand, trace clay (SM)				
	44 50/2"	10	Gray to light Brown fine SAND and Silt, micaceous, horizontal structure, SAPROLITE (SM)			300.55	
	50/1"						
		15	Auger Refusal at 15'			295.55	
Core Run #1			Biotite Gneiss Rock Core Run 1: 15 to 20 feet Recovery: 57/60 inches = 95% RQD: 35/60 inches = 58%			290.55	Water level elevation from data collected in December 2021
Core Run #2		20	Biotite Gneiss Rock Core Run 2: 20 to 25 feet Recovery: 41/60 inches = 68% RQD: 16/60 inches = 27%				
Core Run #3		25	Biotite Gneiss Rock Core Run 3: 25 to 30 feet Recovery: 58/60 inches = 97% RQD: 31/60 inches = 52%			285.55	
Core Run #4		30	Biotite Gneiss Rock Core Run 4: 30 to 35 feet Recovery: 60/60 inches = 100% RQD: 45/60 inches = 75%			280.55	

Project:	Green Ridge Recycling	Boring/Well Area:	North Area of Cell	Drilling Rig Type:	Track Rig CME 45
Project #:	2101370	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3731134.94	Sampling Method:	Rock Core
Start Date:	11/30/21	Easting:	11590828.91	Well Material:	2" Schedule 40 PVC
Completion Date:	12/01/21	Ground Elevation:	310.55	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	55.0	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	312.55	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
Core Run #5			Biotite Gneiss Rock Core Run 5: 35 to 40 feet Recovery: 60/60 inches = 100% RQD: 54.5/60 inches = 91%				
Core Run #6		40	Biotite Gneiss Rock Core Run 6: 40 to 45 feet Recovery: 58/60 inches = 97% RQD: 54.5/60 inches = 91%			270.55	
Core Run #7		45	Biotite Gneiss Rock Core Run 7: 45 to 50 feet Recovery: 59/60 inches = 98% RQD: 42/60 inches = 70%			265.55	
Core Run #8		50	Biotite Gneiss Rock Core Run 8: 50 to 55 feet Recovery: 58/60 inches = 97% RQD: 55/60 inches = 92%			260.55	
		55				255.55	
		60				250.55	
		65				245.55	

BORING/WELL LOG

 Boring/Well ID: **DAA-112pz**

Page 1 of 1

Project:	Green Ridge Recycling	Boring/Well Area:	South Area of Cell	Drilling Rig Type:	Track Rig CME 45
Project #:	2101370	Logged By:	D. Coakley	Drilling Method:	4.25" Hollow Stem Auger
Location:	Cumberland County, VA	Northing:	3726429.45	Sampling Method:	Split Spoon
Start Date:	11/29/21	Easting:	11590969.56	Well Material:	2" Schedule 40 PVC
Completion Date:	11/29/21	Ground Elevation:	351.20	Screen Size:	0.10 Slot
Contractor:	Blue Ridge Drilling	Total Depth:	18'	Filter Pack:	#2 Sand
Driller:	James Jones	TOC Elevation:	353.49	Seal:	Bentonite Pellets/Hydrated

N Value	Blow Counts	Depth	Description (USCS)	Geol	Well Log	ELEV.	Remarks
6	2 3 3 5 3 3 3 3 2 2 3 4 4 3 4 5 3 4 4 8		Light Tan Silty CLAY, trace fine Sand (ML)				Loose
7	3 3 4 3 2 2 3 4 4 3 4 5 3 4 4 8		Gray Silty CLAY, little fine Sand (ML)				
7	3 3 4 4 3 4 5 3 4 4 8	5	Gray SILT, some fine Sand, trace Clay (SM)			346.20	
9	3 3 4 4 3 4 5 3 4 4 8		Drk Gray fine SAND, brown Silt bands, micaceous (SM)				Approx. Depth to GW during drilling
12	3 3 4 4 3 4 5 3 4 4 8		Grayish Tan Fine SAND, some Silt, micaceous (SM)				Medium Dense
22	3 3 4 4 3 4 5 3 4 4 8	10				341.20	
25	3 3 4 4 3 4 5 3 4 4 8						
51	3 3 4 4 3 4 5 3 4 4 8						Very Dense
>50	3 3 4 4 3 4 5 3 4 4 8	15	Light Brown fine SAND, some Silt, white sand lenses, horizontal structure, SAPROLITE (SM)			336.20	
>50	3 3 4 4 3 4 5 3 4 4 8		Auger Refusal at 18'				
		20				331.20	
		25				326.20	
		30				321.20	

ATTACHMENT 3

TABLE 1 – BORING LOG COMPLETION DETAILS

DATED 04/12/2022

TABLE 1 (Revised April 12, 2022 - light green cells)

Boring Log Completion Details
Groundwater and Bedrock Elevation Data
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

Boring ID	Completion Date	Auger Refusal Depth (ft bgs)	Rock Core Depth (ft bgs)	Current Status	Depth to Groundwater (feet above mean sea level)			Well/Boring Elevations				Groundwater Elevations			Proposed Base Grade Elevation	Bedrock Elevation
					04/11/19	05/31/19	10/29/19	Top of Casing	Top of Screen	Bottom of Screen	Ground Surface	04/11/19	05/31/19	10/29/19		
B-1	11/30/17	51	-	1" Piezometer	37.06	36.14	36.65	375.59	339.63	323.63	374.63	338.53	339.45	338.94	343.88	323.63
B-2	11/30/17	32	32 to 42	Sealed Boring	-	-	-	-	-	-	358.28	-	-	-	336.72	326.28
B-3	12/01/17	25.5	25.5 to 35.5	1" Piezometer	19.90	19.40	20.06	348.89	312.33	322.33	347.83	328.99	329.49	328.83	330.84	322.33
B-4	12/01/17	25.5	-	Sealed Boring	-	-	-	-	-	-	329.63	-	-	-	311.74	304.13
B-5	12/04/17	10	-	Sealed Boring	-	-	-	-	-	-	315.00	-	-	-	na	305.00
B-6	12/12/17	40	40 to 50	Sealed Boring	-	-	-	-	-	-	355.46	-	-	-	na	315.46
B-7	12/05/17	55	-	1" Piezometer	31.78	30.53	31.84	353.71	312.33	297.33	352.33	321.93	323.18	321.87	na	297.33
B-8	12/04/17	36	-	1" Piezometer	36.15	35.15	35.20	331.21	304.26	294.26	330.26	295.06	296.06	296.01	na	294.26
B-9	12/01/17	21	-	Sealed Boring	-	-	-	-	-	-	310.55	-	-	-	296.59	289.55
B-10	12/05/17	47	-	1" Piezometer	29.72	29.19	30.10	342.16	309.19	294.19	341.19	312.44	312.97	312.06	na	294.19
B-11	12/05/17	40	-	Sealed Boring	-	-	-	-	-	-	320.32	-	-	-	na	280.32
B-12	12/06/17	40	-	1" Piezometer	10.82	13.08	19.55	337.01	315.89	295.89	335.89	326.19	323.93	317.46	na	295.89
B-13	12/07/17	25	-	Sealed Boring	-	-	-	-	-	-	332.58	-	-	-	na	307.58
B-14	12/07/17	42.5	-	1" Piezometer	30.34	31.16	33.87	291.89	258.00	248.00	290.50	261.55	260.73	258.02	na	248.00
B-15	12/08/17	11	-	Sealed Boring	-	-	-	-	-	-	265.88	-	-	-	na	254.88
B-16	12/08/17	30	-	Sealed Boring	-	-	-	-	-	-	320.00	-	-	-	na	290.00
B-17	11/12/17	47	-	1" Piezometer	31.38	30.15	30.99	383.46	354.37	334.37	381.37	352.08	353.31	352.47	na	334.37
B-18	12/14/17	30	30 to 40	1" Piezometer	13.81	13.94	16.60	366.17	350.42	325.42	365.42	352.36	352.23	349.57	350.80	335.42
B-19	12/13/17	46.5	-	Sealed Boring	-	-	-	-	-	-	363.66	-	-	-	na	317.16
B-20	12/15/17	38	38 to 48	1" Piezometer	34.65	34.05	34.90	349.61	316.15	301.15	349.15	314.96	315.56	314.71	na	311.15
DAA-1sb	02/21/19	21.5	21.5 to 31.5	Sealed Boring	-	-	-	-	-	-	348.25	-	-	-	333.52	326.75
DAA-2sb	02/25/19	51.5	-	Sealed Boring	-	-	-	-	-	-	355.61	-	-	-	324.80	304.11
DAA-3sb	02/25/19	> 62	-	Sealed Boring	-	-	-	-	-	-	348.39	-	-	-	336.21	< 286.39
DAA-4sb	02/26/19	39	-	Sealed Boring	-	-	-	-	-	-	347.44	-	-	-	344.21	308.44
DAA-5pz	02/26/19	35.5	-	2" Piezometer	20.32	19.56	21.25	356.50	325.99	320.99	356.49	336.18	336.94	335.25	339.97	320.99
DAA-6pz	02/26/19	23.5	-	2" Piezometer	18.25	18.13	21.20	335.19	314.42	309.42	332.92	316.94	317.06	313.99	327.60	309.42
DAA-7sb	02/27/19	63.5	-	Sealed Boring	-	-	-	-	-	-	352.90	-	-	-	na	289.40
DAA-8pz	02/27/19	36	-	2" Piezometer	8.47	9.59	13.55	365.46	338.19	328.19	364.19	356.99	355.87	351.91	na	328.19
DAA-9pz	02/28/19	25	-	2" Piezometer	19.89	19.71	21.70	365.68	350.25	340.25	365.25	345.79	345.97	343.98	351.02	340.25
DAA-10pz	02/28/19	31	-	2" Piezometer	22.95	22.66	24.60	341.55	313.45	308.45	339.45	318.60	318.89	316.95	323.74	308.45
DAA-11pz	02/28/19	23	-	2" Piezometer	dry	23.75	dry	336.30	317.07	312.07	335.07	Dry	312.55	Dry	na	312.07
DAA-12pz	03/04/19	25.5	-	2" Piezometer	22.34	22.35	26.00	331.20	309.57	304.57	330.07	308.86	308.85	305.20	313.28	304.57
DAA-13pz	03/04/19	34	-	2" Piezometer	24.82	24.66	27.05	359.36	328.96	323.96	357.96	334.54	334.70	332.31	337.19	323.96
DAA-14pz	03/05/19	42	-	2" Piezometer	36.79	35.75	35.30	381.44	343.13	338.13	380.13	344.65	345.69	346.14	350.44	338.13
DAA-15pz-s	03/05/19	34	-	2" Piezometer	24.53	24.08	25.20	331.15	300.98	295.98	329.98	306.62	307.07	305.95	311.69	295.98
DAA-15pz-d	03/05/19	29	29 to 39	2" Piezometer	24.72	24.25	25.30	331.34	300.71	290.71	329.71	306.62	307.09	306.04	na	300.71
DAA-16pz	03/06/19	26	-	2" Piezometer	21.68	27.57	dry	324.60	302.02	297.02	323.02	302.92	297.03	Dry	na	297.02
DAA-17sb	03/06/19	22.5	-	Sealed Boring	-	-	-	-	-	-	332.69	-	-	-	na	310.19
DAA-18pz	03/07/19	27	-	2" Piezometer	17.68	18.26	21.83	343.46	320.12	315.12	342.12	325.78	325.20	321.63	na	315.12
DAA-19pz-s	03/07/19	21.5	-	2" Piezometer	17.00	17.68	20.40	325.94	308.84	303.84	325.34	308.94	308.26	305.54	na	303.84
DAA-19pz-d	03/11/19	23	23 to 33	2" Piezometer	18.17	18.80	22.20	327.09	306.18	296.18	325.18	308.92	308.29	304.89	na	302.18
DAA-20pz	03/11/19	34	-	2" Piezometer	dry	dry	dry	313.62	283.39	278.39	312.39	Dry	Dry	Dry	na	278.39
DAA-21sb	03/12/19	47	-	Sealed Boring	-	-	-	-	-	-	315.47	-	-	-	na	268.47

TABLE 1 (Revised April 12, 2022 - light green cells)

Boring Log Completion Details
Groundwater and Bedrock Elevation Data
Green Ridge Recycling and Disposal Facility
Cumberland, Virginia

Boring ID	Completion Date	Auger Refusal Depth (ft bgs)	Rock Core Depth (ft bgs)	Current Status	Depth to Groundwater (feet above mean sea level)			Well/Boring Elevations				Groundwater Elevations			Proposed Base Grade Elevation	Bedrock Elevation
					04/11/19	05/31/19	10/29/19	Top of Casing	Top of Screen	Bottom of Screen	Ground Surface	04/11/19	05/31/19	10/29/19		
DAA-22pz	03/12/19	> 55	-	2" Piezometer	37.55	35.86	35.48	324.70	278.33	268.33	323.33	287.15	288.84	289.22	na	< 268.33
DAA-23pz-s	03/13/19	33	-	2" Piezometer	28.59	26.34	29.20	320.61	290.63	285.63	318.63	292.02	294.27	291.41	na	285.63
DAA-23pz-d	03/13/19	37	37 to 47	2" Piezometer	27.98	26.26	23.82	318.67	280.94	270.94	317.94	290.69	292.41	294.85	na	280.94
DAA-24pz	03/13/19	23	-	2" Piezometer	22.33	20.27	20.40	291.19	271.87	266.87	289.87	268.86	270.92	270.79	na	266.87
DAA-25pz-s	03/14/19	37	-	2" Piezometer	23.55	23.55	26.00	328.45	294.38	289.38	326.38	304.90	304.90	302.45	na	289.38
DAA-25pz-d	03/14/19	37	37 to 47	2" Piezometer	21.88	21.95	25.05	327.70	289.58	279.58	326.58	305.82	305.75	302.65	na	289.58
DAA-26pz	03/27/19	48	-	2" Piezometer	28.76	28.07	28.86	305.08	261.20	256.20	304.20	276.32	277.01	276.22	na	256.20
DAA-27sb	03/27/19	21.5	-	Sealed Boring	-	-	-	-	-	-	331.70	-	-	-	305.90	310.20
DAA-28sb	03/28/19	44	-	Sealed Boring	-	-	-	-	-	-	320.28	-	-	-	307.20	276.28
DAA-29pz	03/28/19	34.5	-	2" Piezometer	20.91	20.63	25.60	349.41	318.34	313.34	347.84	328.50	328.78	323.81	326.39	313.34
DAA-30sb	03/28/19	31	-	Sealed Boring	-	-	-	-	-	-	339.93	-	-	-	319.28	308.93
DAA-31pz	03/29/19	33.5	-	2" Piezometer	31.64	31.04	32.20	349.92	320.07	315.07	348.57	318.28	318.88	317.72	321.24	315.07
DAA-32sb	03/29/19	31	-	Sealed Boring	-	-	-	-	-	-	349.82	-	-	-	321.78	318.82
DAA-33sb	04/02/19	17	-	Sealed Boring	-	-	-	-	-	-	348.20	-	-	-	338.98	331.20
DAA-34pz	04/02/19	39.5	-	2" Piezometer	27.65	25.91	26.75	355.38	320.20	315.20	354.70	327.73	329.47	328.63	338.48	315.20
DAA-35pz	04/03/19	38	-	2" Piezometer	31.58	30.95	32.00	367.36	332.58	327.58	365.58	335.78	336.41	335.36	340.89	327.58
DAA-36pz	04/03/19	45	-	2" Piezometer	10.25	10.64	14.04	340.83	300.15	295.15	340.15	330.58	330.19	326.79	na	295.15
DAA-37sb	04/04/19	47.5	-	Sealed Boring	-	-	-	-	-	-	357.48	-	-	-	na	309.98
DAA-38sb	04/04/19	19.5	-	Sealed Boring	-	-	-	-	-	-	307.43	-	-	-	na	287.93
DAA-39sb	04/04/19	25.5	-	Sealed Boring	-	-	-	-	-	-	315.21	-	-	-	na	289.71
DAA-40pz	04/05/19	29	-	2" Piezometer	25.94	26.83	dry	327.50	301.93	296.93	325.93	301.56	300.67	Dry	na	296.93
DAA-41pz	04/08/19	22.5	-	2" Piezometer	22.45	22.83	23.60	307.99	289.02	284.02	306.52	285.54	285.16	284.39	na	284.02
DAA-42pz	05/20/19	48	-	1" Piezometer		27.70	30.25	366.57	320.99	315.99	363.99		338.87	336.32	na	315.99
DAA-43pz	05/20/19	15	-	1" Piezometer		dry	dry	309.32	299.00	294.00	309.00		dry	dry	na	294.00
DAA-44pz	05/20/19	45	-	1" Piezometer		36.90	38.70	382.98	339.96	334.96	379.96		346.08	344.28	na	334.96
DAA-45pz	05/20/19	8	-	1" Piezometer		dry	dry	271.24	266.06	261.06	269.06		Dry	Dry	na	261.06
DAA-46pz	05/20/19	35	-	1" Piezometer		26.78	28.80	364.16	330.77	325.77	360.77		337.38	335.36	na	325.77
DAA-47pz	05/21/19	54	-	1" Piezometer		29.27	31.52	360.91	310.19	305.19	359.19		331.64	329.39	na	305.19
DAA-48pz	05/21/19	18	-	1" Piezometer		dry	dry	317.84	302.50	297.50	315.50		Dry	Dry	na	297.50
DAA-101pz	12/01/21	15	15 to 55	2" Piezometer				313.00	265.55	255.55	310.55				296.59	295.55
DAA-112pz	11/29/21	18		2" Piezometer				353.49	343.20	333.20	351.20				347.75	333.20

Not Applicable: Boring/Piezometer outside of the Limits of Disposal Area

* Data provided by Koontz Bryant

ATTACHMENT PTA-XIII - LABORATORY AND FIELD DATA

As required by §9 VAC 20-81-460.E, laboratory analysis documentation and field data are herein provided as Attachment XIII. This includes slug test results and geotechnical laboratory analysis of soils.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued on April 8, 2021. No comments were received on Attachment PTA-XII under TR 1. However, in order to respond to TR 1, two additional borings were completed, DAA-101pz and DAA-112pz. No additional laboratory or field data was collected during the TR 1 field activities.

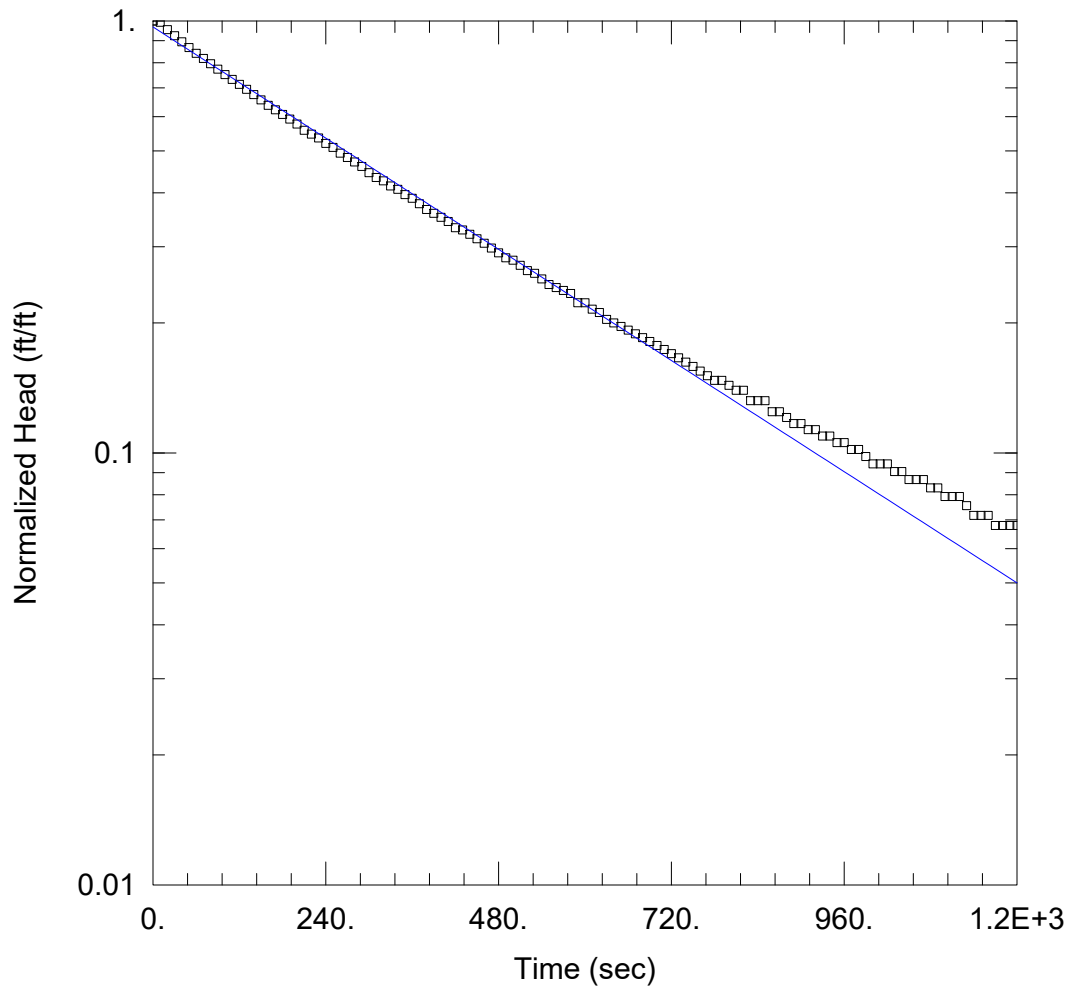
Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with an addendum to TR 2 issued on October 25, 2022. No comments were received on this attachment.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this attachment.

This information is incorporated here as part of the Final Part A Submission.

The following is a list of documents associated with this section:

- Slug Test Data
- Geotechnical Laboratory Test Data



WELL TEST ANALYSIS

Data Set: C:\Users\Bfitzwater\OneDrive - Draper Aden Associates\Desktop\PZ-5 (FHT).aqt
 Date: 07/14/19 Time: 17:23:11

PROJECT INFORMATION

Company: Draper Aden Associates
 Client: Green Ridge
 Project: 18020117-030102
 Location: Cumberland County
 Test Well: PZ-5
 Test Date: 6/03/19

AQUIFER DATA

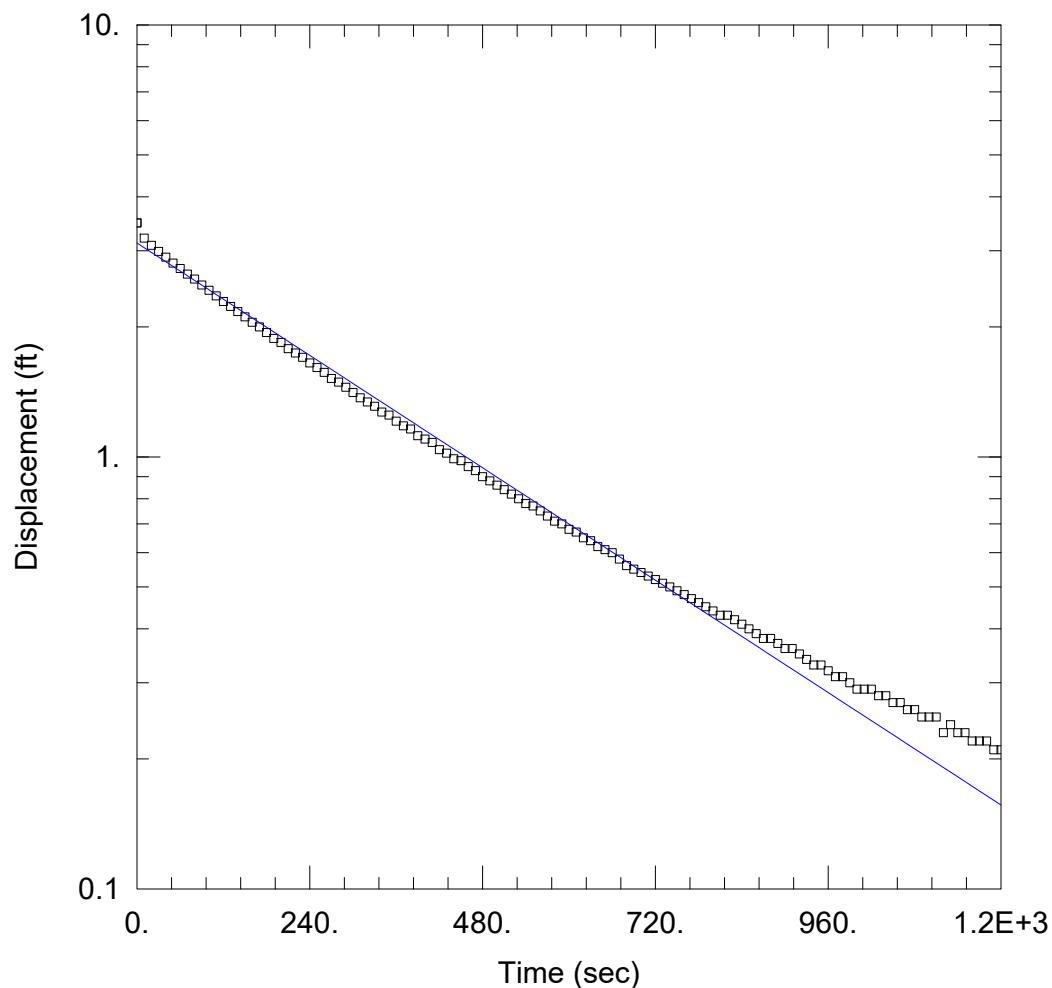
Saturated Thickness: 16.94 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (PZ-5)

Initial Displacement: 2.65 ft Static Water Column Height: 15.94 ft
 Total Well Penetration Depth: 15.94 ft Screen Length: 5. ft
 Casing Radius: 0.083 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 0.2907 ft/day y_0 = 2.566 ft



WELL TEST ANALYSIS

Data Set: C:\Users\Bfitzwater\OneDrive - Draper Aden Associates\Desktop\PZ-5 (RHT).aqt

Date: 07/14/19

Time: 17:30:26

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-5

Test Date: 6/03/19

AQUIFER DATA

Saturated Thickness: 16.94 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-5)

Initial Displacement: 3.48 ft

Static Water Column Height: 15.94 ft

Total Well Penetration Depth: 15.94 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

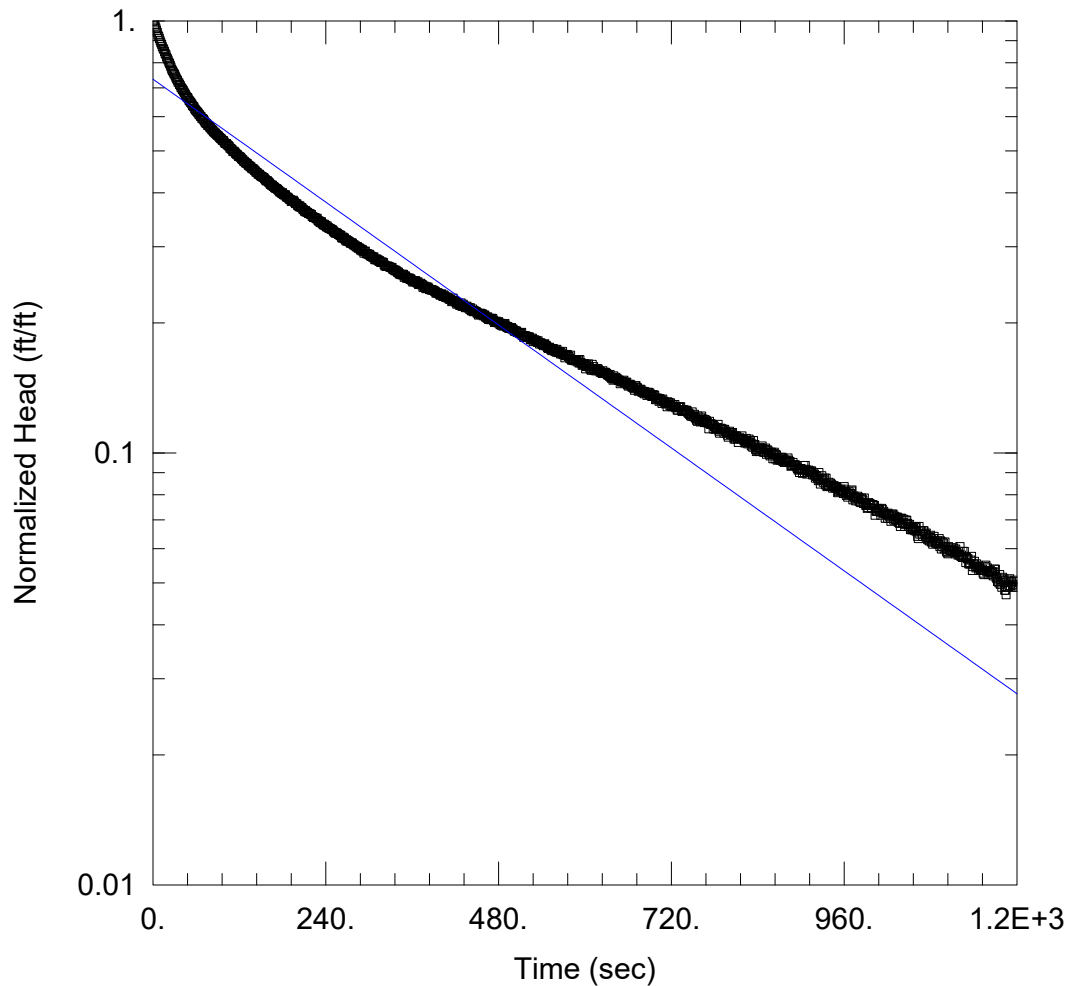
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.294$ ft/day

$y_0 = 3.128$ ft



FALLING HEAD TEST

Data Set: P:\2018\1802\0100\18020117\18020117-030102\WORK\Slug Test Data\PZ-8\PZ-8 FHT.aqt
 Date: 07/15/19 Time: 08:55:09

PROJECT INFORMATION

Company: Draper Aden Associates
 Client: Green Ridge
 Project: 18020117-030102
 Location: Cumberland County
 Test Well: PZ-8
 Test Date: 6/06/19

AQUIFER DATA

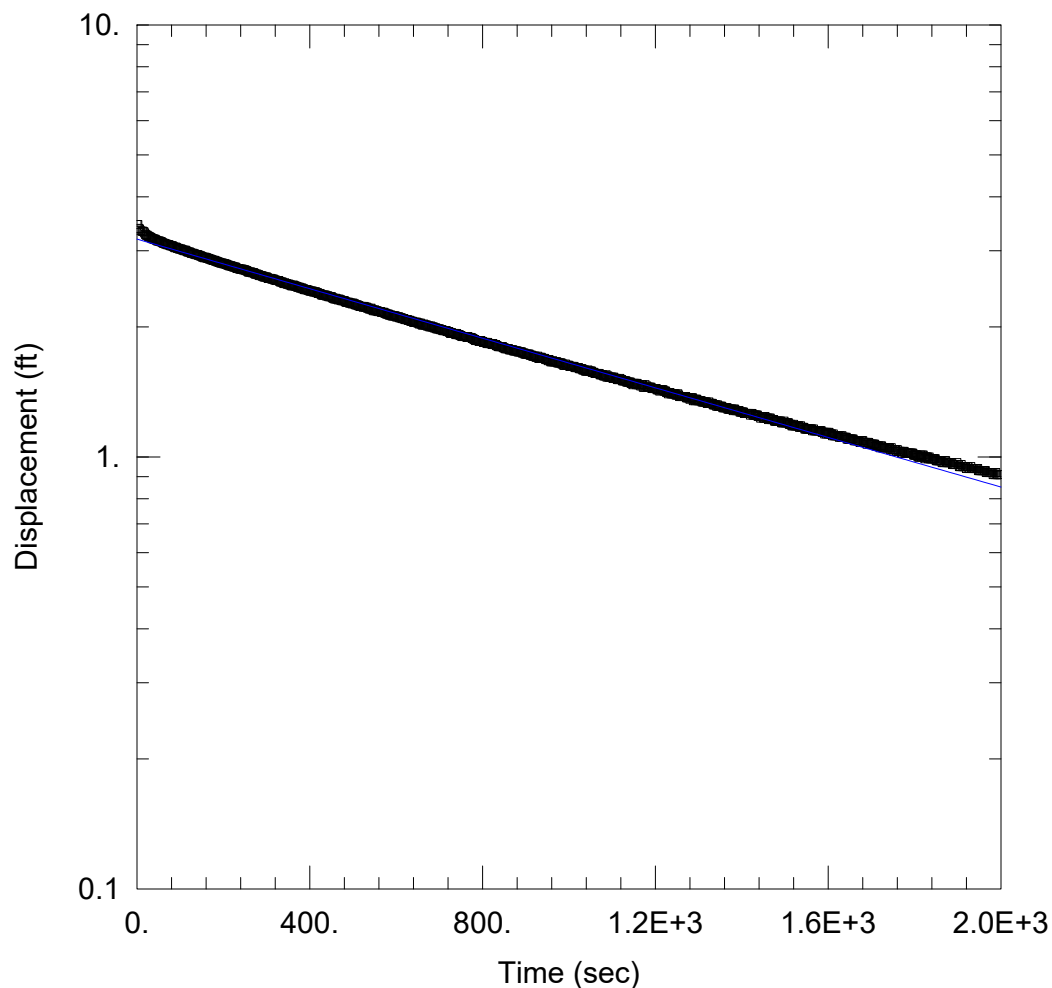
Saturated Thickness: 28.57 ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (PZ-8)

Initial Displacement: 2.62 ft Static Water Column Height: 27.57 ft
 Total Well Penetration Depth: 27.57 ft Screen Length: 10. ft
 Casing Radius: 0.083 ft Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice
 K = 0.2052 ft/day y0 = 1.92 ft



RISING HEAD TEST

Data Set: C:\...\PZ-8 RHT.aqt

Date: 07/14/19

Time: 15:43:14

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-8

Test Date: 6/06/19

AQUIFER DATA

Saturated Thickness: 28.57 ft

Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (PZ-8)

Initial Displacement: 3.45 ft

Static Water Column Height: 27.57 ft

Total Well Penetration Depth: 27.57 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Well Radius: 0.085 ft

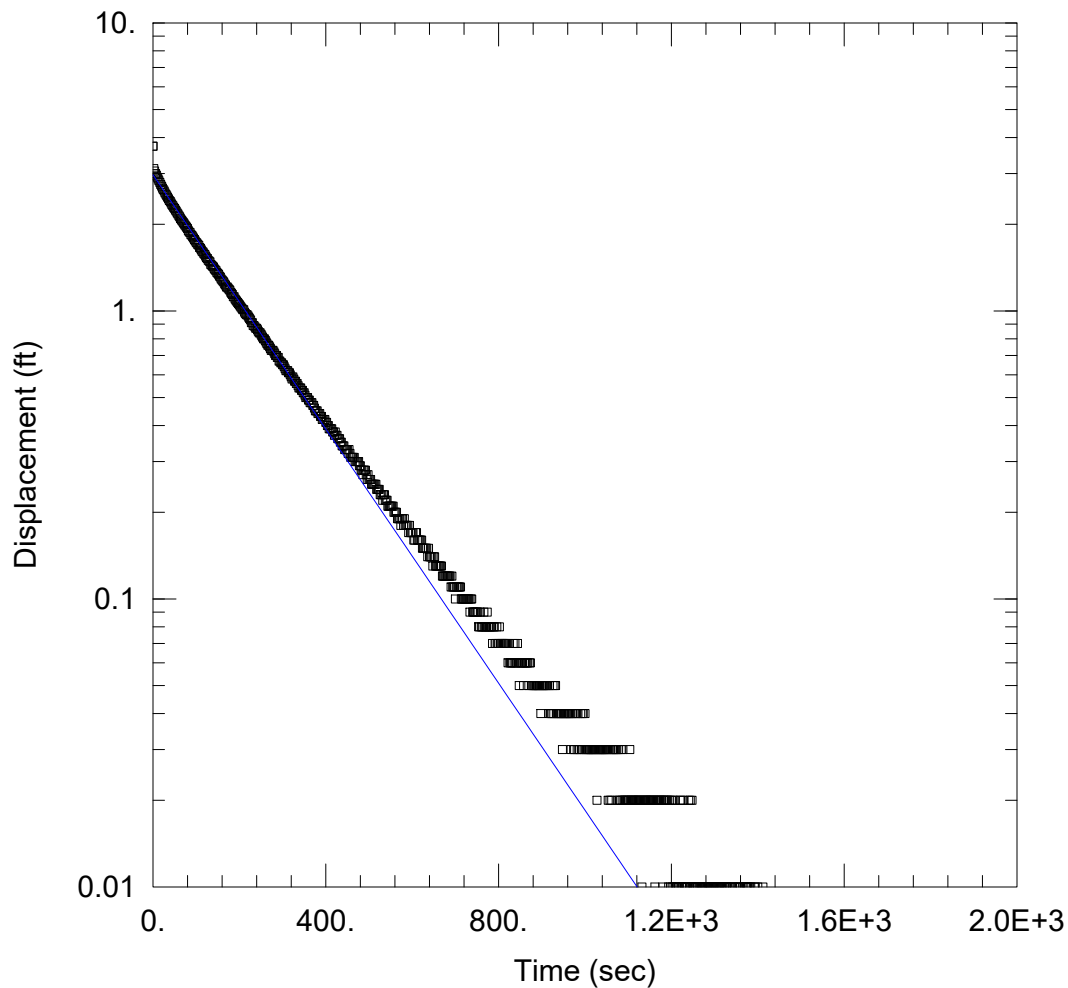
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.06899 ft/day

y0 = 3.193 ft



FALLING HEAD TEST

Data Set: C:\...\PZ-22 FHT.aqt

Date: 07/14/19

Time: 15:56:40

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-22

Test Date: 6/06/19

AQUIFER DATA

Saturated Thickness: 21.67 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-22)

Initial Displacement: 3.73 ft

Static Water Column Height: 20.67 ft

Total Well Penetration Depth: 20.67 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

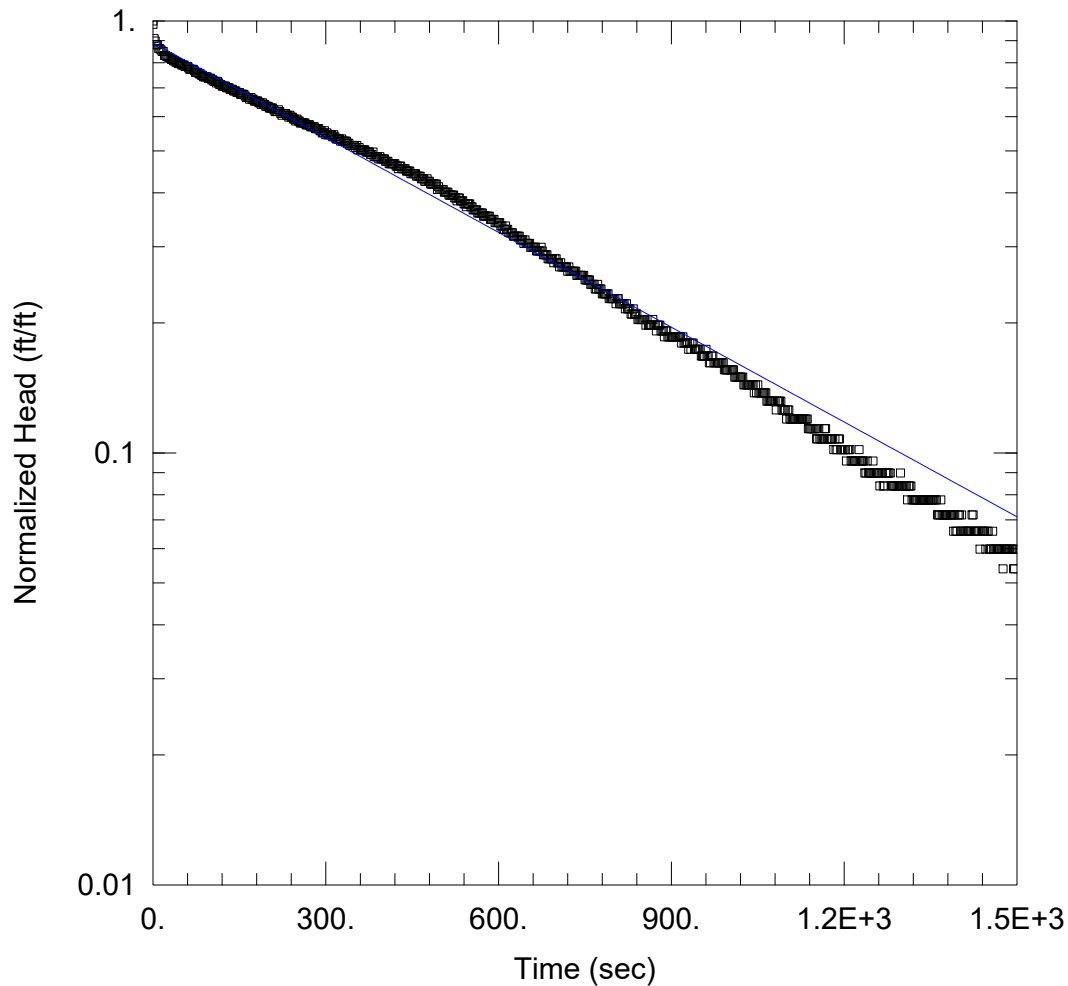
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.3637$ ft/day

$y_0 = 2.969$ ft



RISING HEAD TEST

Data Set: C:\...\PZ-22 RHT.aqt

Date: 07/14/19

Time: 16:00:59

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-22

Test Date: 6/06/19

AQUIFER DATA

Saturated Thickness: 21.67 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-22)

Initial Displacement: 1.67 ft

Static Water Column Height: 20.67 ft

Total Well Penetration Depth: 20.67 ft

Screen Length: 10. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

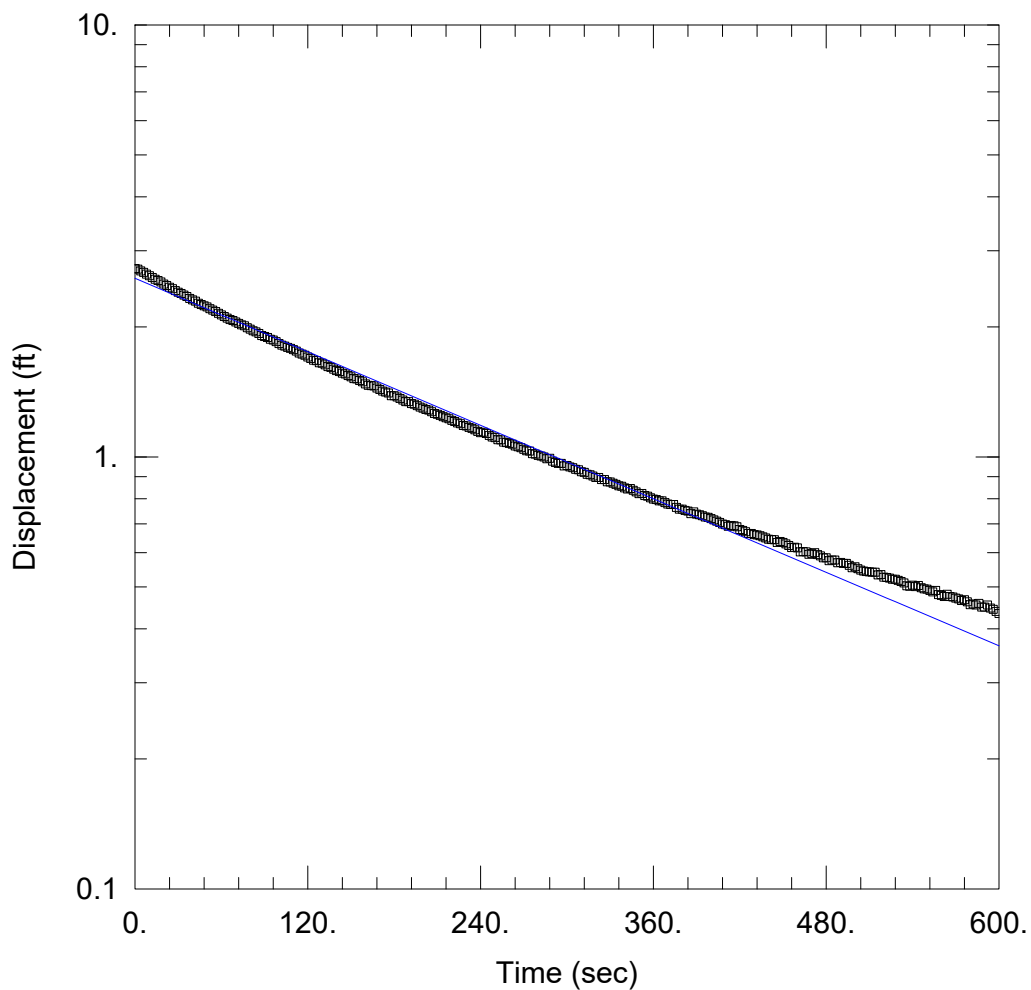
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1206$ ft/day

$y_0 = 1.486$ ft



FALLING HEAD TEST

Data Set: P:\...\PZ-25 (FHT).aqt

Date: 07/14/19

Time: 15:27:23

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-25 (Shallow)

Test Date: 6/03/19

AQUIFER DATA

Saturated Thickness: 16.4 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-25 (Shallow))

Initial Displacement: 2.73 ft

Static Water Column Height: 15.4 ft

Total Well Penetration Depth: 15.4 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

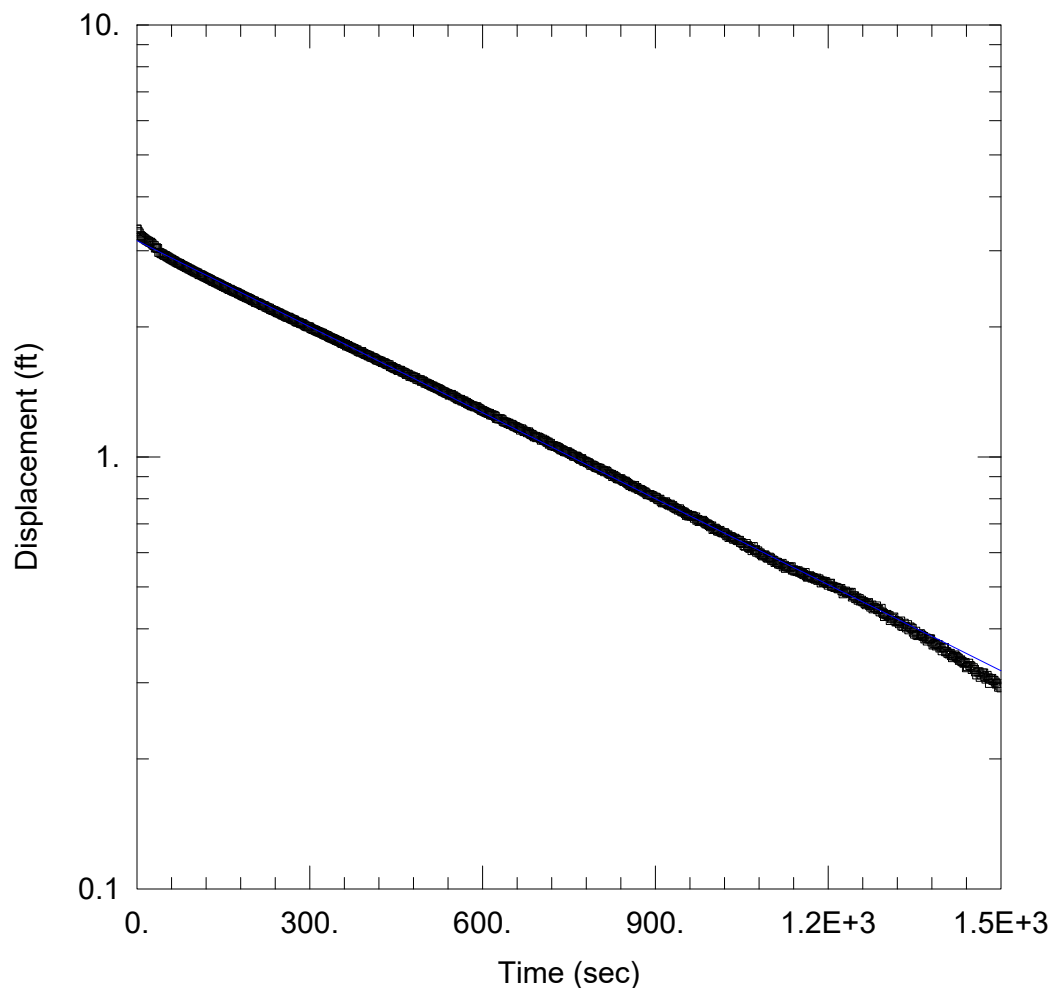
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

K = 0.3823 ft/day

y_0 = 2.592 ft



RISING HEAD TEST

Data Set: P:\...\PZ-25 (RHT).aqt

Date: 07/14/19

Time: 15:03:04

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-25 (Shallow)

Test Date: 6/03/19

AQUIFER DATA

Saturated Thickness: 16.4 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-25 (Shallow))

Initial Displacement: 3.37 ft

Static Water Column Height: 15.4 ft

Total Well Penetration Depth: 15.4 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

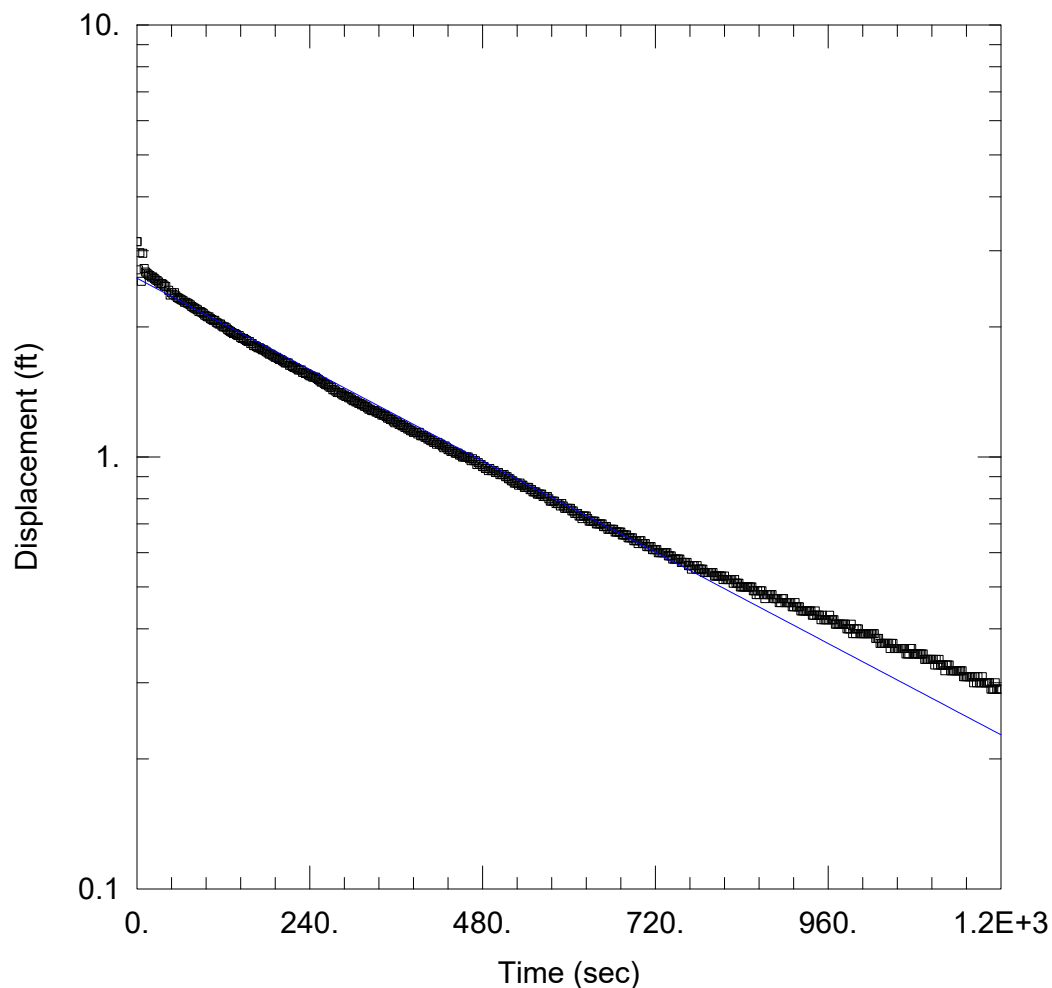
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1789$ ft/day

$y_0 = 3.165$ ft



FALLING HEAD TEST

Data Set: C:\...\Falling Head Test.aqt

Date: 07/14/19

Time: 16:40:12

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-26

Test Date: 5/16/19

AQUIFER DATA

Saturated Thickness: 21.67 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-26)

Initial Displacement: 3.15 ft

Static Water Column Height: 20.67 ft

Total Well Penetration Depth: 20.67 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

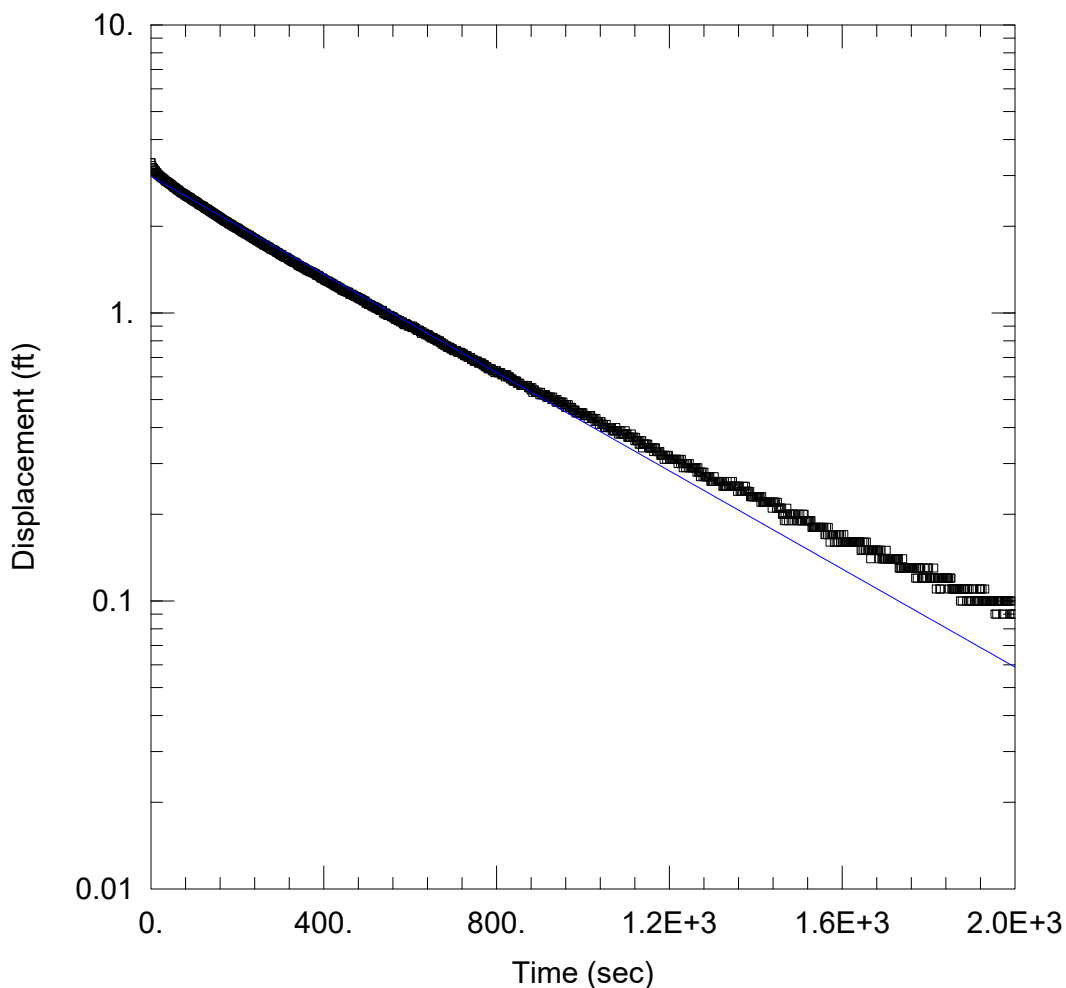
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.2489$ ft/day

$y_0 = 2.592$ ft



RISING HEAD TEST

Data Set: C:\...\Rising Head Test.aqt

Date: 07/14/19

Time: 16:45:57

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-26

Test Date: 5/16/19

AQUIFER DATA

Saturated Thickness: 21.67 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-26)

Initial Displacement: 3.32 ft

Static Water Column Height: 20.67 ft

Total Well Penetration Depth: 20.67 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

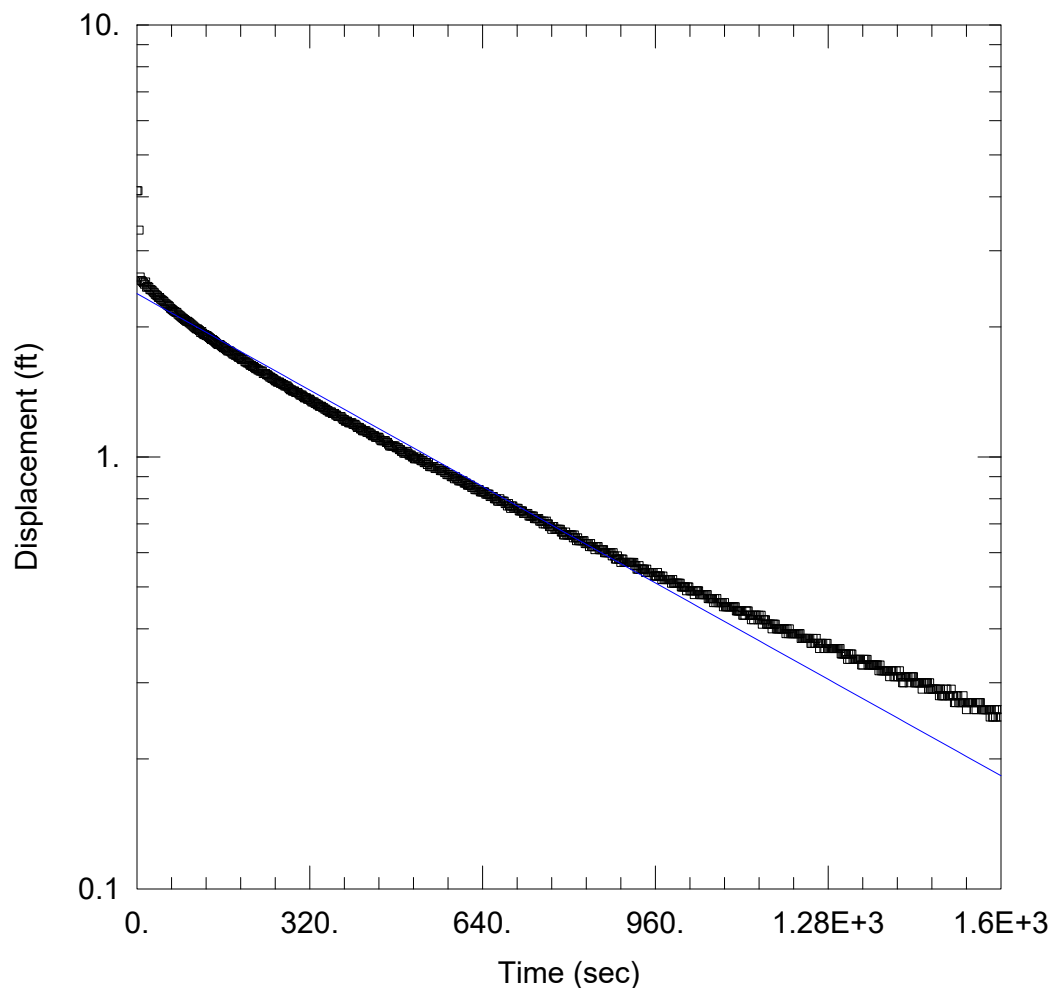
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.2407$ ft/day

$y_0 = 2.977$ ft



FALLING HEAD TEST

Data Set: P:\...\PZ-29 (FHT).aqt

Date: 07/14/19

Time: 16:23:08

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-29

Test Date: 6/06/19

AQUIFER DATA

Saturated Thickness: 16.89 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-29)

Initial Displacement: 4.13 ft

Static Water Column Height: 15.89 ft

Total Well Penetration Depth: 15.89 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

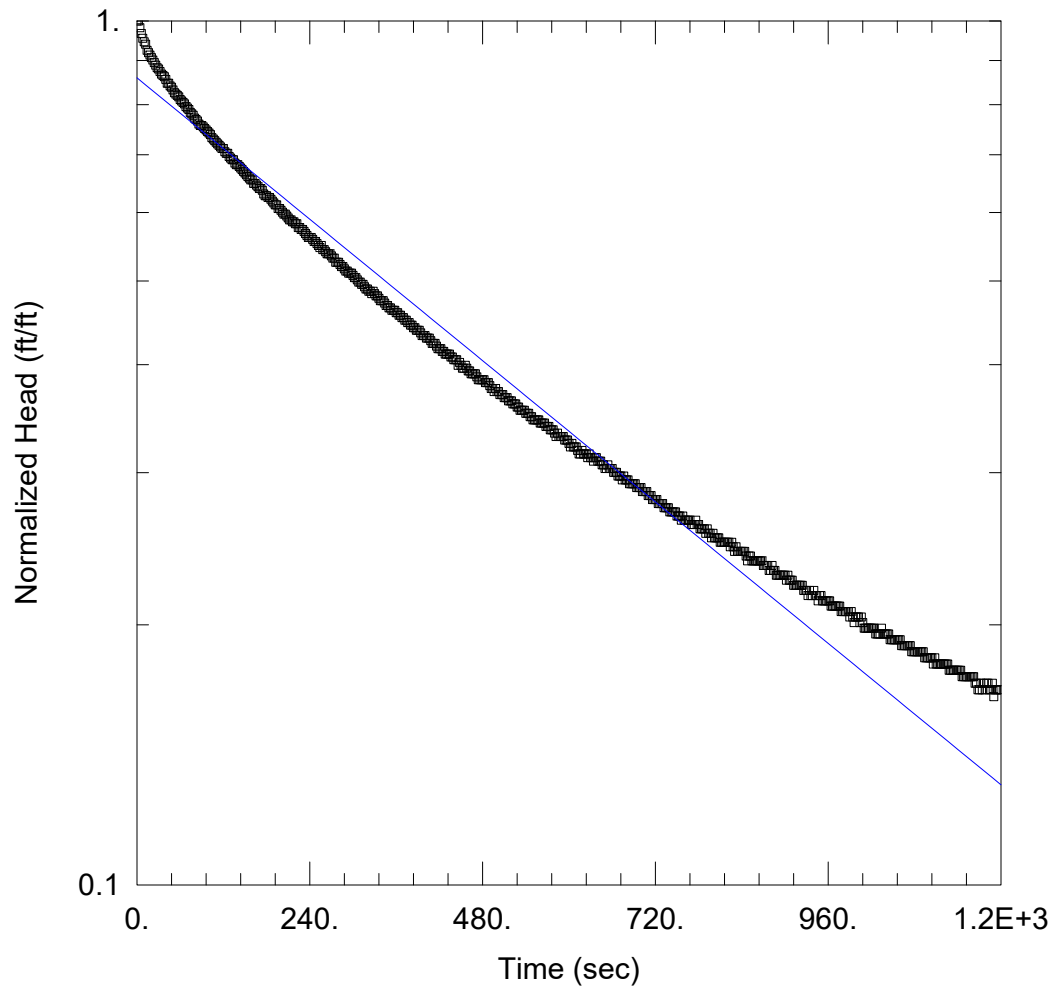
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.189$ ft/day

$y_0 = 2.387$ ft



RISING HEAD TEST

Data Set: P:\...\PZ-29 (RHT).aqt

Date: 07/14/19

Time: 16:20:51

PROJECT INFORMATION

Company: Draper Aden Associates

Client: Green Ridge

Project: 18020117-030102

Location: Cumberland County

Test Well: PZ-29

Test Date: 6/06/19

AQUIFER DATA

Saturated Thickness: 16.89 ft

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (PZ-29)

Initial Displacement: 3.33 ft

Static Water Column Height: 15.89 ft

Total Well Penetration Depth: 15.89 ft

Screen Length: 5. ft

Casing Radius: 0.083 ft

Well Radius: 0.33 ft

SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 0.1848$ ft/day

$y_0 = 2.861$ ft

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-01	DAA-02	DAA-02	DAA-02	DAA-03	DAA-03	DAA-03	DAA-03
<u>Sample Depth</u>	6'-8'	16'-18'	24'-26'	38'-40'	6'-8'	10'-12'	20'-22'	28'-30'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
<u>Visual Description</u>	Brown	Brownish-Gray	Gray	Light Yellowish-Brown	Light Brownish-Gray	Brown	Brownish-Gray	Light Brownish-Gray

Classification Data

<u>Natural Moisture Content, %</u>	19.9%	21.4%	9.0%	7.3%	42.4%	45.7%	49.4%	53.3%
<u>Liquid Limit</u>	Np	53	Np	Np	63	65	69	73
<u>Plastic Limit</u>	Np	45	Np	Np	48	44	44	41
<u>Plastic Index</u>	Np	8	Np	Np	15	21	25	32
<u>Passing No. 200 Sieve, %</u>	23.7%	20.7%	18.8%	16.9%	77.3%	79.6%	85.6%	78.0%
<u>USCS Group Symbol</u>	SM	SM	SM	SM	MH	MH	MH	MH
<u>USCS Group Name</u>	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Elastic SILT with Sand	Elastic SILT with Sand	Elastic SILT	Elastic SILT with Sand

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-03	DAA-03	DAA-04	DAA-04	DAA-04	DAA-04	DAA-04	DAA-04
<u>Sample Depth</u>	45'-47'	55'-57'	10'-12'	12'-14'	18'-20'	24'-26'	28'-30'	36'-38'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
<u>Visual Description</u>	Brownish-Gray	Brown	Light Brownish-Gray	Light Red-Brown	Brown	Light Gray	Brown	Brown

Classification Data

<u>Natural Moisture Content, %</u>	51.3%	43.3%	44.1%	32.8%	49.8%	36.3%	33.3%	26.2%
<u>Liquid Limit</u>	56	63	44	Np	52	Np	41	Np
<u>Plastic Limit</u>	34	35	33	Np	42	Np	34	Np
<u>Plastic Index</u>	22	28	11	Np	10	Np	7	Np
<u>Passing No. 200 Sieve, %</u>	74.4%	69.9%	42.6%	33.6%	45.3%	31.1%	37.6%	30.6%
<u>USCS Group Symbol</u>	MH	MH	SM	SM	SM	SM	SM	SM
<u>USCS Group Name</u>	Elastic SILT with Sand	Sandy Elastic SILT	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-05	DAA-05	DAA-06	DAA-07	DAA-07	DAA-07	DAA-08	DAA-08
<u>Sample Depth</u>	7'-9'	15'-17'	12'-14'	10'-12'	14'-16'	55'-57'	6'-8'	10'-11.5'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Shelby-Tube
<u>Visual Description</u>	Light Brownish-Gray	Light Red-Brown	Light Brown	Brownish-Gray	Brownish-Gray	Dark Red-brown	Reddish-Brown	Gray

Classification Data

<u>Natural Moisture Content, %</u>	7.1%	7.4%	4.8%	29.1%	24.4%	52.3%	32.7%	41.6%
<u>Liquid Limit</u>	Np	Np	Np	56	40	59	53	Np
<u>Plastic Limit</u>	Np	Np	Np	34	28	44	48	Np
<u>Plastic Index</u>	Np	Np	Np	22	12	15	5	Np
<u>Passing No. 200 Sieve, %</u>	16.6%	18.4%	17.1%	31.1%	25.9%	54.7%	39.8%	27.9%
<u>USCS Group Symbol</u>	SM	SM	SM	SM	SM	SM	SM	SM
<u>USCS Group Name</u>	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Sandy Elastic SILT	Silty SAND	Silty SAND

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-08	DAA-08	DAA-09	DAA-09	DAA-10	DAA-10	DAA-12	DAA-13
<u>Sample Depth</u>	12'-14'	20'-22'	6'-8'	20'-22'	22'-24'	24'-26'	25'-27'	8'-10'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
<u>Visual Description</u>	Brown	Brownish-Gray	Light Brown	Brownish-Gray	Brownish-Gray	Gray	Gray	Light Brown

Classification Data

<u>Natural Moisture Content, %</u>	43.8%	28.0%	31.3%	12.4%	11.8%	11.6%	3.7%	21.1%
<u>Liquid Limit</u>	43	Np	57	Np	36	Np	Np	39
<u>Plastic Limit</u>	36	Np	44	Np	28	Np	Np	29
<u>Plastic Index</u>	7	Np	13	Np	8	Np	Np	10
<u>Passing No. 200 Sieve, %</u>	26.4%	22.9%	42.3%	16.4%	17.8%	29.5%	18.2%	30.6%
<u>USCS Group Symbol</u>	SM	SM	SM	SM	SM	SM	SM	SM
<u>USCS Group Name</u>	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-13	DAA-13	DAA-13	DAA-14	DAA-14	DAA-14	DAA-14	DAA-14
<u>Sample Depth</u>	14'-16'	26'-28'	28'-30'	6'-8'	10'-12'	14'-16'	24'-26'	26'-28'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
<u>Visual Description</u>	Brown	Brownish-Gray	Light Brown	Reddish-Brown	Reddish-Brown	Reddish-Brown	Reddish-Brown	Light Brown

Classification Data

<u>Natural Moisture Content, %</u>	12.6%	17.4%	15.1%	30.8%	36.7%	33.9%	38.4%	18.3%
<u>Liquid Limit</u>	34	Np	Np	66	72	66	55	Np
<u>Plastic Limit</u>	27	Np	Np	41	37	42	40	Np
<u>Plastic Index</u>	7	Np	Np	25	35	24	15	Np
<u>Passing No. 200 Sieve, %</u>	25.4%	17.5%	31.5%	54.4%	71.9%	51.5%	48.1%	26.4%
<u>USCS Group Symbol</u>	SM	SM	SM	MH	MH	MH	SM	SM
<u>USCS Group Name</u>	Silty SAND	Silty SAND	Silty SAND	Sandy Elastic SILT	Elastic SILT with Sand	Sandy Elastic SILT	Silty SAND	Silty SAND

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data

<u>Sample ID</u>	DAA-14	DAA-17	DAA-17	DAA-18	DAA-19	DAA-20	DAA-21	DAA-22
<u>Sample Depth</u>	30'-32'	6'-8'	10'-12'	6'-8'	6'-8'	14'-16'	6'-8'	6'-8'
<u>Sample Type</u>	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
<u>Visual Description</u>	Light Red-Brown	Light Brown	Brownish-Gray	Light Brown	Brownish-Gray	Brownish-Gray	Light Brown	Light Brown

Classification Data

<u>Natural Moisture Content, %</u>	13.8%	9.1%	8.6%	27.3%	17.6%	11.4%	14.8%	19.4%
<u>Liquid Limit</u>	Np	Np	41	Np	41	Np	38	Np
<u>Plastic Limit</u>	Np	Np	26	Np	26	Np	27	Np
<u>Plastic Index</u>	Np	Np	14	Np	15	Np	11	Np
<u>Passing No. 200 Sieve, %</u>	25.0%	27.8%	25.6%	23.1%	22.4%	26.7%	25.1%	29.8%
<u>USCS Group Symbol</u>	SM	SM	SM	SM	SM	SM	SM	SM
<u>USCS Group Name</u>	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND

Standard Proctor Data

<u>Maximum Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Optimum Moisture Content, %</u>	-	-	-	-	-	-	-	-

Permeability Data

<u>Compacted Dry Density, pcf</u>	-	-	-	-	-	-	-	-
<u>Percent Compaction, %</u>	-	-	-	-	-	-	-	-
<u>Compacted Moisture Content, %</u>	-	-	-	-	-	-	-	-
<u>Deviation from Optimum</u>	-	-	-	-	-	-	-	-
<u>Permeability, cm/sec</u>	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-22	DAA-22	DAA-23	DAA-23	DAA-23	DAA-25	DAA-25	DAA-26
Sample Depth	10'-12	35'-37'	14'-16'	26'-28'	28'-29.5'	6'-8'	16'-18'	2'-4'
Sample Type	Jar	Jar	Jar	Jar	Shelby-Tube	Jar	Jar	Jar
Visual Description	Brown	Brownish-Gray	Reddish-Brown	Brownish-Gray	Gray	Light Brown	Light Brown	Light Red-Brown
Classification Data								
Natural Moisture Content, %	20.9%	8.1%	22.3%	16.7%	16.5%	39.4%	24.0%	41.5%
Liquid Limit	Np	Np	Np	Np	Np	61	62	79
Plastic Limit	Np	Np	Np	Np	Np	38	38	37
Plastic Index	Np	Np	Np	Np	Np	23	24	42
Passing No. 200 Sieve, %	13.5%	15.5%	30.0%	16.0%	18.9%	40.3%	31.9%	93.8%
USCS Group Symbol	SM	SM	SM	SM	SM	SM	SM	MH
USCS Group Name	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Elastic SILT
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-26	DAA-26	DAA-26	DAA-26	DAA-26	DAA-26	DAA-26	DAA-26
Sample Depth	4'-6'	8'-10'	18'-20'	20'-22'	22'-24'	24'-26'	28'-30'	34'-36'
Sample Type	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
Visual Description	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown	Light Brown
Classification Data								
Natural Moisture Content, %	36.3%	36.1%	46.0%	58.8%	59.4%	60.2%	52.0%	26.3%
Liquid Limit	61	Np	64	67	62	69	51	54
Plastic Limit	38	Np	52	55	46	53	37	42
Plastic Index	23	Np	12	12	16	16	14	12
Passing No. 200 Sieve, %	86.8%	79.7%	70.3%	88.3%	80.9%	87.3%	61.8%	32.0%
USCS Group Symbol	MH	ML	MH	MH	MH	MH	MH	SM
USCS Group Name	Elastic SILT	SILT with Sand	Elastic SILT with Sand	Elastic SILT	Elastic SILT with Sand	Elastic SILT	Sandy Elastic SILT	Silty SAND
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-27	DAA-27	DAA-27	DAA-28	DAA-28	DAA-28	DAA-28	DAA-28
Sample Depth	2'-4'	14'-16'	16'-18'	2'-4'	4'-6'	10'-12'	28'-30'	34'-36'
Sample Type	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
Visual Description	Light Brown	Light Brownish-Gray	Light Gray	Dark Brown	Light Red-Brown	Light Brown	Brownish-Gray	Brown
Classification Data								
Natural Moisture Content, %	7.4%	12.2%	7.5%	24.7%	21.5%	16.1%	9.3%	18.5%
Liquid Limit	Np	Np	Np	38	52	39	Np	Np
Plastic Limit	Np	Np	Np	22	29	29	Np	Np
Plastic Index	Np	Np	Np	16	23	10	Np	Np
Passing No. 200 Sieve, %	23.2%	35.4%	25.9%	42.7%	33.4%	30.4%	19.1%	22.1%
USCS Group Symbol	SM	SM	SM	SC	SM	SM	SM	SM
USCS Group Name	Silty SAND	Silty SAND	Silty SAND	Clayey SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-29	DAA-29	DAA-29	DAA-29	DAA-33	DAA-33	DAA-33	DAA-33
Sample Depth	2'-4'	6'-8'	12'-14'	24'-26'	2'-4'	4'-6'	6'-8'	8'-10'
Sample Type	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
Visual Description	Light Brown	Brown	Brown	Reddish-Brown	Red	Light Red-Brown	Light Brown	Light Gray
Classification Data								
Natural Moisture Content, %	19.4%	30.8%	36.6%	30.0%	27.7%	27.3%	21.9%	13.0%
Liquid Limit	48	63	53	51	64	60	Np	32
Plastic Limit	24	34	41	35	38	33	Np	21
Plastic Index	24	29	12	16	26	27	Np	11
Passing No. 200 Sieve, %	28.8%	23.0%	23.8%	37.4%	36.0%	29.2%	20.2%	40.9%
USCS Group Symbol	SC	SM	SM	SM	SM	SM	SM	SC
USCS Group Name	Clayey SAND	Silty SAND with Gravel	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Clayey SAND
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-33	DAA-33	DAA-34	DAA-34	DAA-34	DAA-35	DAA-35	DAA-35
Sample Depth	10'-12'	12'-14'	2'-4'	6'-8'	20'-22'	2'-4'	4'-6'	6'-8'
Sample Type	Jar	Jar	Jar	Jar	Jar	Jar	Jar	Jar
Visual Description	Light Gray	Light Red-Brown	Reddish-Brown	Light Brown	Light Brown	Red	Red	Reddish-Brown
Classification Data								
Natural Moisture Content, %	12.7%	8.5%	26.8%	10.1%	19.2%	20.9%	39.2%	30.1%
Liquid Limit	35	Np	65	35	Np	46	65	50
Plastic Limit	18	Np	20	19	Np	23	30	39
Plastic Index	17	Np	45	16	Np	23	35	11
Passing No. 200 Sieve, %	31.7%	20.5%	49.0%	17.4%	28.9%	57.7%	41.4%	39.4%
USCS Group Symbol	SC	SM	SC	SC	SM	CL	SC	SM
USCS Group Name	Clayey SAND	Silty SAND	Clayey SAND	Clayey SAND	Silty SAND	Sandy Lean CLAY	Clayey SAND	Silty SAND
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data								
Sample ID	DAA-36	DAA-36	DAA-36	DAA-36	DAA-37	DAA-40	DAA-40	DAA-40
Sample Depth	4'-6'	6'-8'	22'-24'	35'-37'	4'-6'	5'	10'	15'
Sample Type	Jar	Jar	Jar	Jar	Jar	Cuttings	Cuttings	Cuttings
Visual Description	Reddish-Brown	Light Brown	Light Brown	Light Red-Brown	Red	Reddish-Brown	Reddish-Brown	Brown
Classification Data								
Natural Moisture Content, %	35.4%	38.3%	31.9%	24.1%	25.8%	28.4%	19.9%	24.9%
Liquid Limit	69	54	43	41	52	54	42	63
Plastic Limit	52	34	29	30	33	35	32	34
Plastic Index	17	20	14	11	19	19	10	29
Passing No. 200 Sieve, %	40.7%	48.3%	27.2%	31.7%	46.0%	50.4%	40.9%	44.8%
USCS Group Symbol	SM	SM	SM	SM	SM	MH	SM	SM
USCS Group Name	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Silty SAND	Sandy Elastic SILT	Silty SAND	Silty SAND
Standard Proctor Data								
Maximum Dry Density, pcf	-	-	-	-	-	-	-	-
Optimum Moisture Content, %	-	-	-	-	-	-	-	-
Permeability Data								
Compacted Dry Density, pcf	-	-	-	-	-	-	-	-
Percent Compaction, %	-	-	-	-	-	-	-	-
Compacted Moisture Content, %	-	-	-	-	-	-	-	-
Deviation from Optimum	-	-	-	-	-	-	-	-
Permeability, cm/sec	-	-	-	-	-	-	-	-

Summary Of Laboratory Tests

**Green Ridge,
Cumberland County Landfill**

DAA# 18020117-030102

Prepared By: CBW Date: 6/11/2019

Sample Data							
Sample ID	DAA-40	East	East	West	West		
Sample Depth	25'	0'-2.5'	2.5'-5.0'	0'-2.5'	2.5'-5.0'		
Sample Type	Cuttings	Bulk	Bulk	Bulk	Bulk		
Visual Description	Brown	Brown	Light Brown	Brown	Brown		
Classification Data							
Natural Moisture Content, %	11.9%	9.4%	5.9%	18.4%	17.0%		
Liquid Limit	Np	33	34	55	54		
Plastic Limit	Np	20	20	22	22		
Plastic Index	Np	13	14	33	32		
Passing No. 200 Sieve, %	35.9%	33.9%	30.1%	46.9%	58.4%		
USCS Group Symbol	SM	SC	SC	SC	CH		
USCS Group Name	Silty SAND	Clayey SAND	Clayey SAND	Clayey SAND	Sandy Fat CLAY		
Standard Proctor Data							
Maximum Dry Density, pcf	-	113.7	108.8	101.2	103.2		
Optimum Moisture Content, %	-	13.6%	16.7%	18.0%	20.1%		
Permeability Data							
Compacted Dry Density, pcf	-	110.6	105.8	98.1	99.5		
Percent Compaction, %	-	97.3%	97.2%	96.9%	96.4%		
Compacted Moisture Content, %	-	14.3%	17.5%	20.3%	21.3%		
Deviation from Optimum	-	0.7%	0.8%	2.3%	1.2%		
Permeability, cm/sec	-	1.10E-07	1.00E-07	7.60E-08	7.10E-08		

Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-01

Sample Depth 6'-8'

Visual Sample Description Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	41
Pan Wt	194.41 grams
Pan + Soil (wet)	301.24 grams
Pan + Soil (dry)	283.50 grams
Natural Moisture Content	19.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	262.40 grams
Percent Passing No. 200 Sieve	23.7%
Pan + Soil retained on No. 4 sieve	
(dry)	194.41 grams
Percent Passing No. 4 Sieve	100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/15/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			

Liquid Limit

Liquid Limit

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		

Plastic Limit

Plastic Index

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

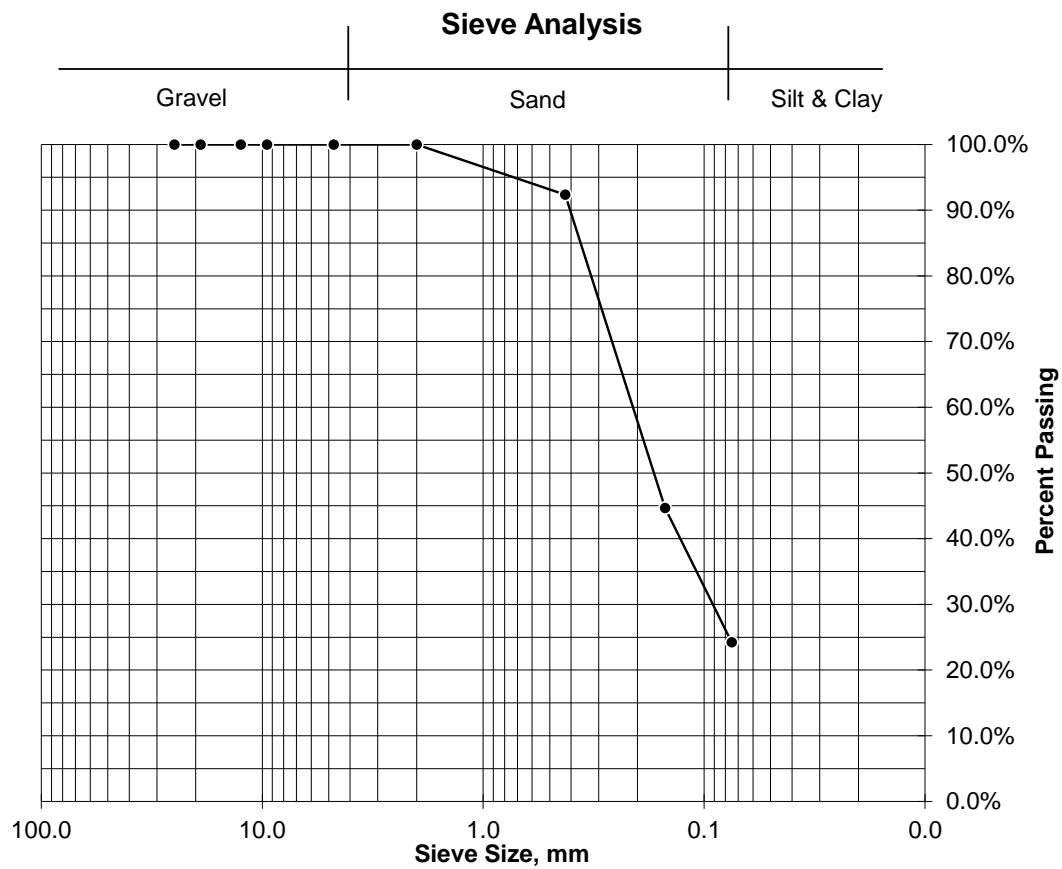
Prepared By: CBW

Sample ID DAA-01

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	6.79	7.6%	0.425	92.4%
No. 100	42.51	47.7%	0.15	44.7%
No. 200	18.21	20.4%	0.075	24.2%
Pan	0.45	0.5%		
Total	67.96	76.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-02

Sample Depth 16'-18'

Visual Sample Description Micaceous Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	21
Pan Wt	193.80 grams
Pan + Soil (wet)	296.90 grams
Pan + Soil (dry)	278.75 grams
Natural Moisture Content	21.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 261.20 grams

Percent Passing No. 200 Sieve 20.7%

Pan + Soil retained on No. 4 sieve

(dry) 193.80 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	15	22	34
Pan ID	97	103	104
Pan Wt	26.10	27.43	26.26
Pan + Soil (wet)	44.31	45.25	40.90
Pan + Soil (dry)	37.59	39.04	36.08
Moisture Content	58.5%	53.5%	49.1%
Liquid Limit	55	53	51
Liquid Limit	53		

Plastic Limit

Pan ID	315	356
Pan Weight	9.14	9.09
Pan + Soil (wet)	21.79	23.44
Pan + Soil (dry)	17.89	19.00
Moisture Content	44.6%	44.8%
Plastic Limit	45	
Plastic Index	8	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-02

Sample Depth 16'-18'

Mechanical Sieve Analysis: ASTM D 422

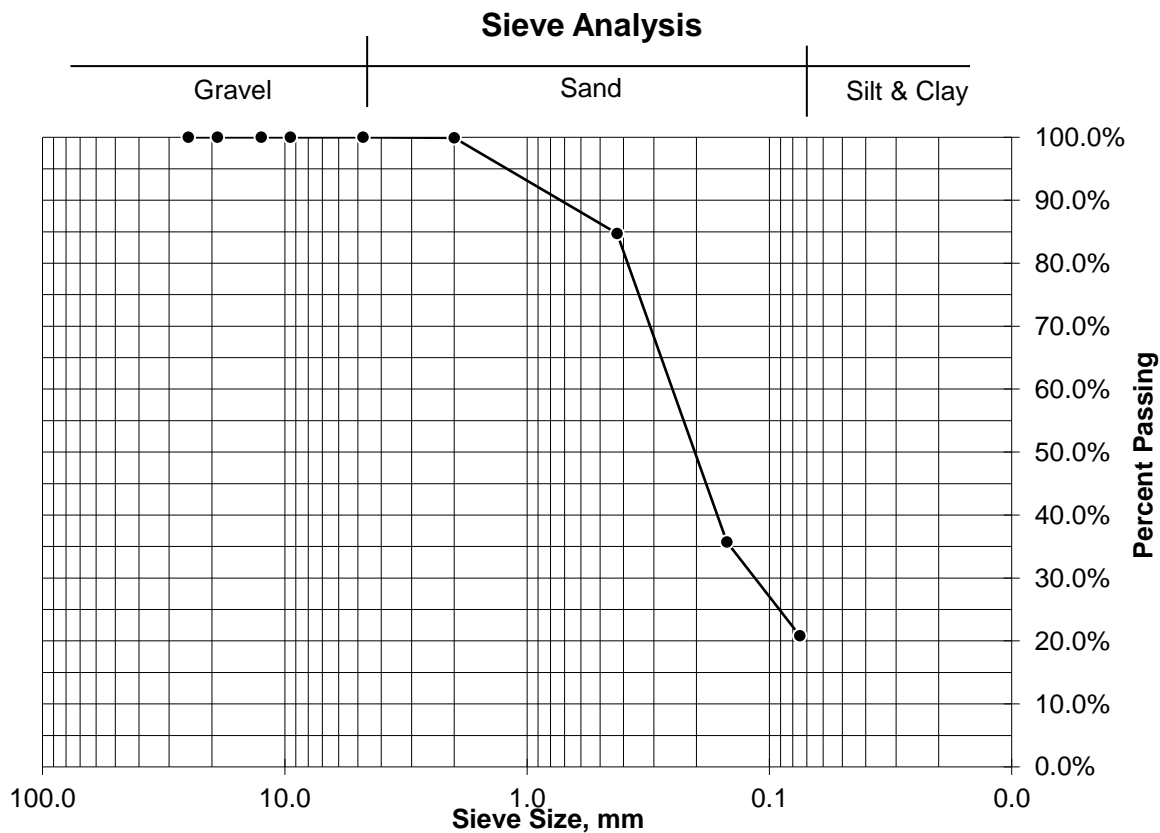


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Richmond, VA 23227

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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.07	0.1%	2.00	99.9%
No. 40	12.92	15.2%	0.425	84.7%
No. 100	41.59	49.0%	0.15	35.8%
No. 200	12.65	14.9%	0.075	20.9%
Pan	0.16	0.2%		
Total	67.39	79.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-02

Sample Depth 24'-26'

Visual Sample Description Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	124
Pan Wt	124.38 grams
Pan + Soil (wet)	229.97 grams
Pan + Soil (dry)	221.28 grams
Natural Moisture Content	9.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 203.04 grams

Percent Passing No. 200 Sieve 18.8%

Pan + Soil retained on No. 4 sieve

(dry) 124.38 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-02

Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

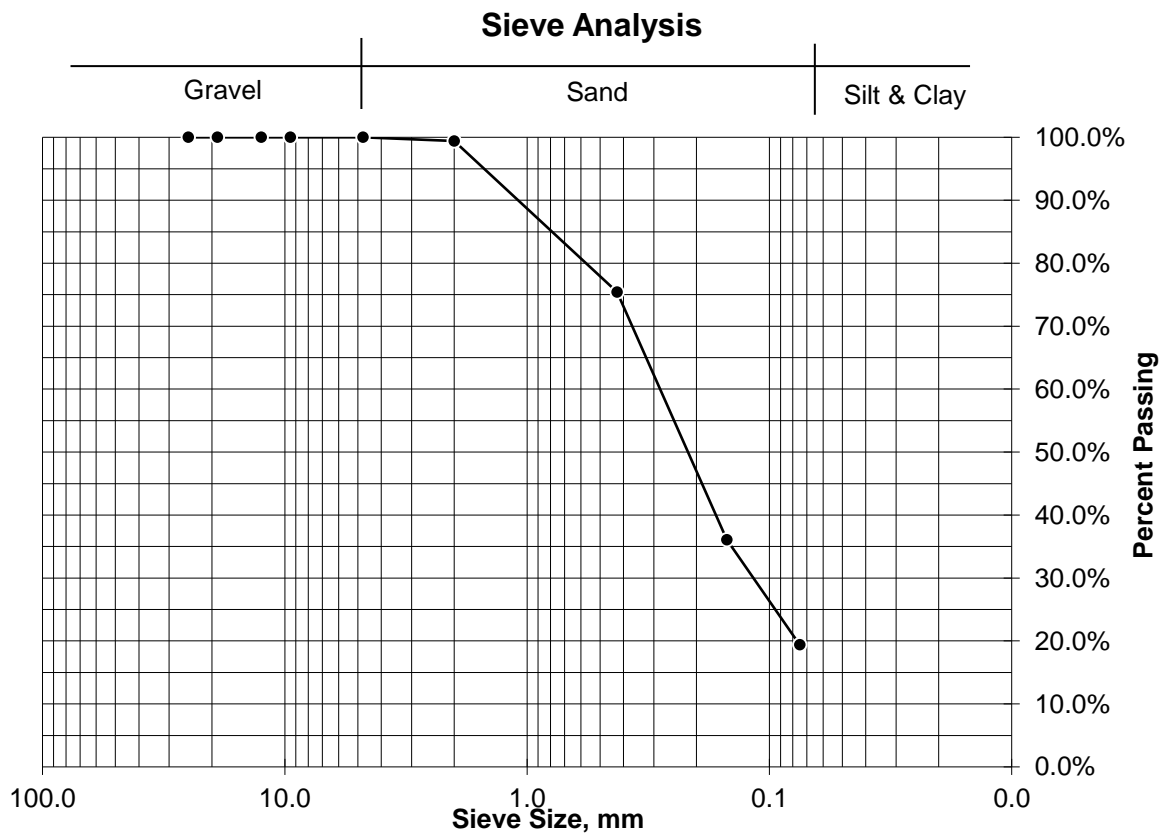


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.56	0.6%	2.00	99.4%
No. 40	23.25	24.0%	0.425	75.4%
No. 100	38.15	39.4%	0.15	36.1%
No. 200	16.14	16.7%	0.075	19.4%
Pan	0.54	0.6%		
Total	78.64	81.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-02

Sample Depth 38'-40'

Visual Sample Description Light Yellowish-Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	19
Pan Wt	188.60 grams
Pan + Soil (wet)	289.46 grams
Pan + Soil (dry)	282.64 grams
Natural Moisture Content	7.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 266.73 grams

Percent Passing No. 200 Sieve 16.9%

Pan + Soil retained on No. 4 sieve

(dry) 188.60 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-02

Sample Depth 38'-40'

Mechanical Sieve Analysis: ASTM D 422

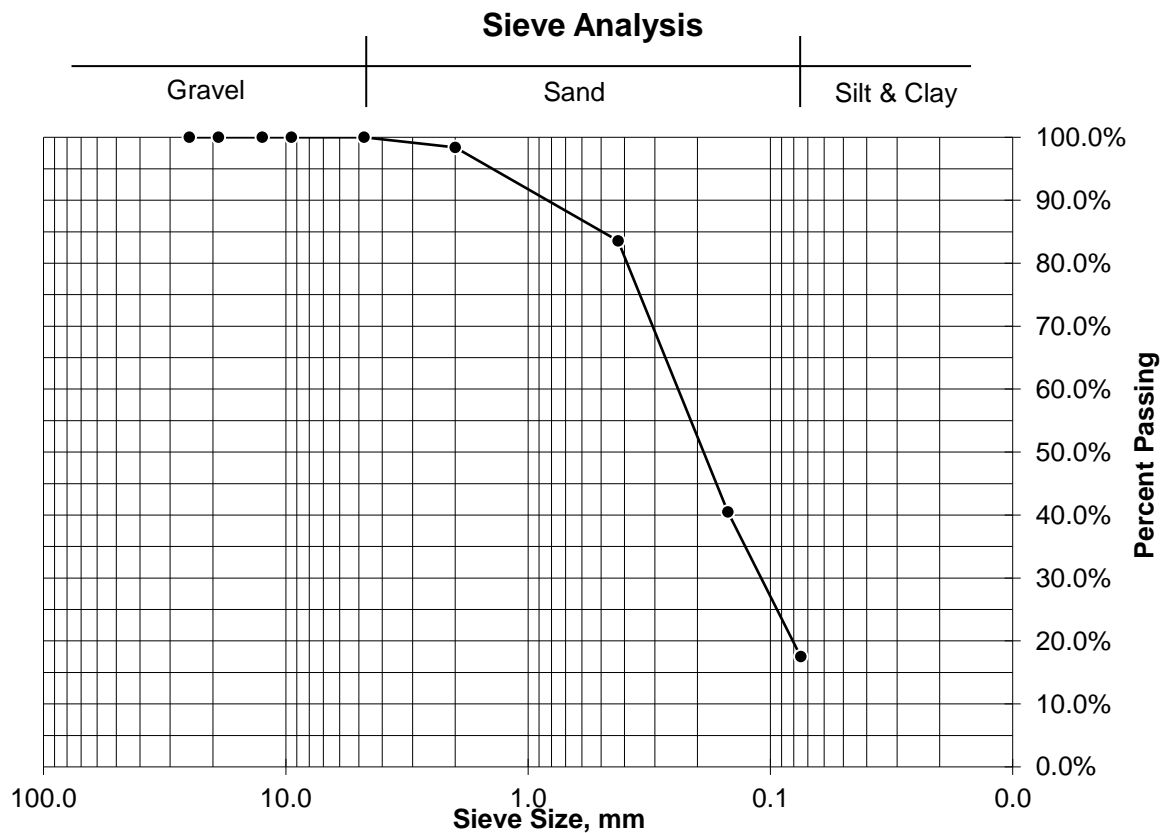


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.53	1.6%	2.00	98.4%
No. 40	13.93	14.8%	0.425	83.6%
No. 100	40.48	43.0%	0.15	40.5%
No. 200	21.61	23.0%	0.075	17.5%
Pan	0.58	0.6%		
Total	78.13	83.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Received: 3/19/2019

Sample Depth 6'-8'

Date Tested: 3/19/2019

Visual Sample Description Light Brownish-Gray Elastic SILT with Sand

Natural Moisture Content: ASTM D 2216

Pan ID	4
Pan Wt	194.44 grams
Pan + Soil (wet)	298.58 grams
Pan + Soil (dry)	267.58 grams
Natural Moisture Content	42.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 211.04 grams

Percent Passing No. 200 Sieve 77.3%

Pan + Soil retained on No. 4 sieve

(dry) 194.44 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	15	24	34
Pan ID	94	108	95
Pan Wt	23.78	33.07	24.41
Pan + Soil (wet)	37.72	50.20	42.96
Pan + Soil (dry)	32.02	43.53	36.08
Moisture Content	69.1%	63.8%	59.0%
Liquid Limit	65	63	61
Liquid Limit	63		

Plastic Limit

Pan ID	0	1138
Pan Weight	6.07	6.15
Pan + Soil (wet)	20.20	18.53
Pan + Soil (dry)	15.56	14.52
Moisture Content	48.9%	47.9%
Plastic Limit	48	
Plastic Index	15	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT with Sand

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

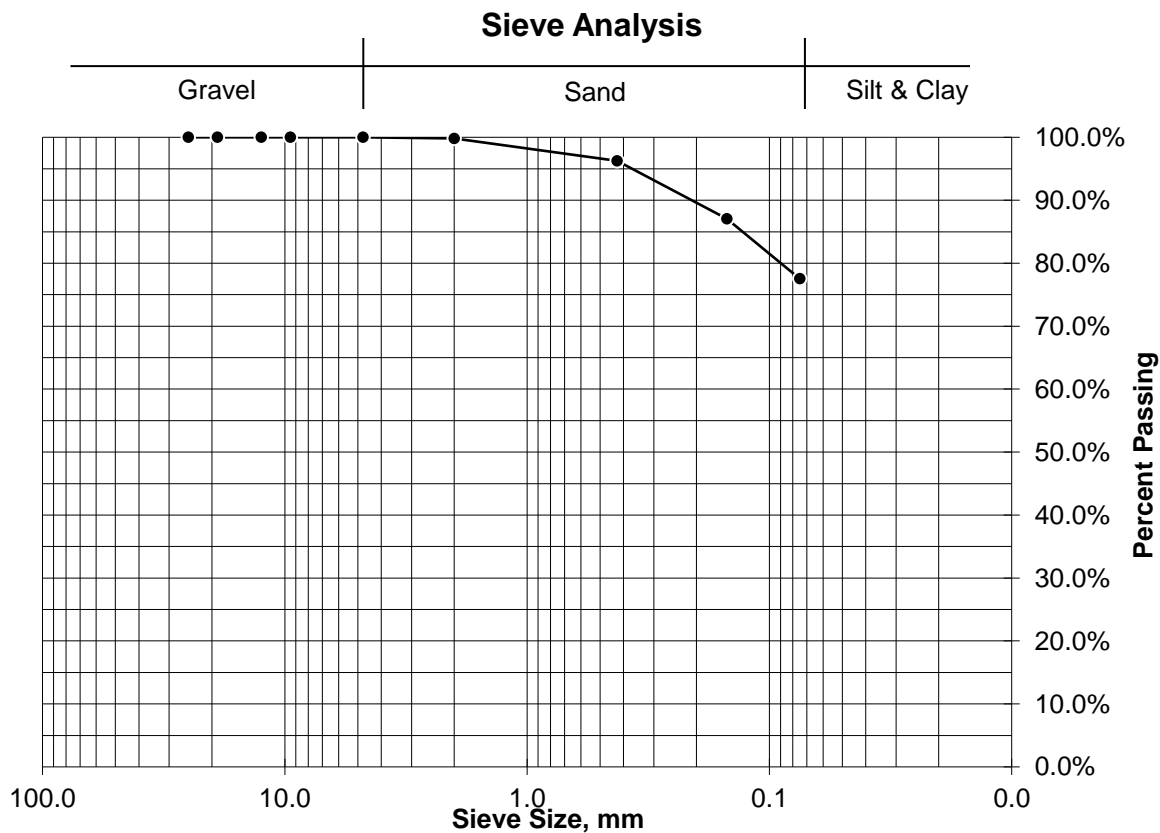
Prepared By: CBW

Sample ID DAA-03

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.15	0.2%	2.00	99.8%
No. 40	2.57	3.5%	0.425	96.3%
No. 100	6.74	9.2%	0.15	87.1%
No. 200	6.97	9.5%	0.075	77.5%
Pan	0.15	0.2%		
Total	16.58	22.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Depth 10'-12'

Visual Sample Description Brown Elastic SILT with Sand

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	11
Pan Wt	187.42 grams
Pan + Soil (wet)	298.94 grams
Pan + Soil (dry)	263.95 grams
Natural Moisture Content	45.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 203.07 grams

Percent Passing No. 200 Sieve 79.6%

Pan + Soil retained on No. 4 sieve

(dry) 187.42 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	19	22	33
Pan ID	96	101	169
Pan Wt	24.80	23.95	27.10
Pan + Soil (wet)	43.27	42.52	46.41
Pan + Soil (dry)	35.71	35.12	39.08
Moisture Content	69.3%	66.2%	61.1%
Liquid Limit	67	65	63
Liquid Limit	65		

Plastic Limit

Pan ID	318	78
Pan Weight	6.17	4.22
Pan + Soil (wet)	18.93	14.41
Pan + Soil (dry)	15.02	11.29
Moisture Content	44.2%	44.1%
Plastic Limit	44	
Plastic Index	21	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT with Sand

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-03

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

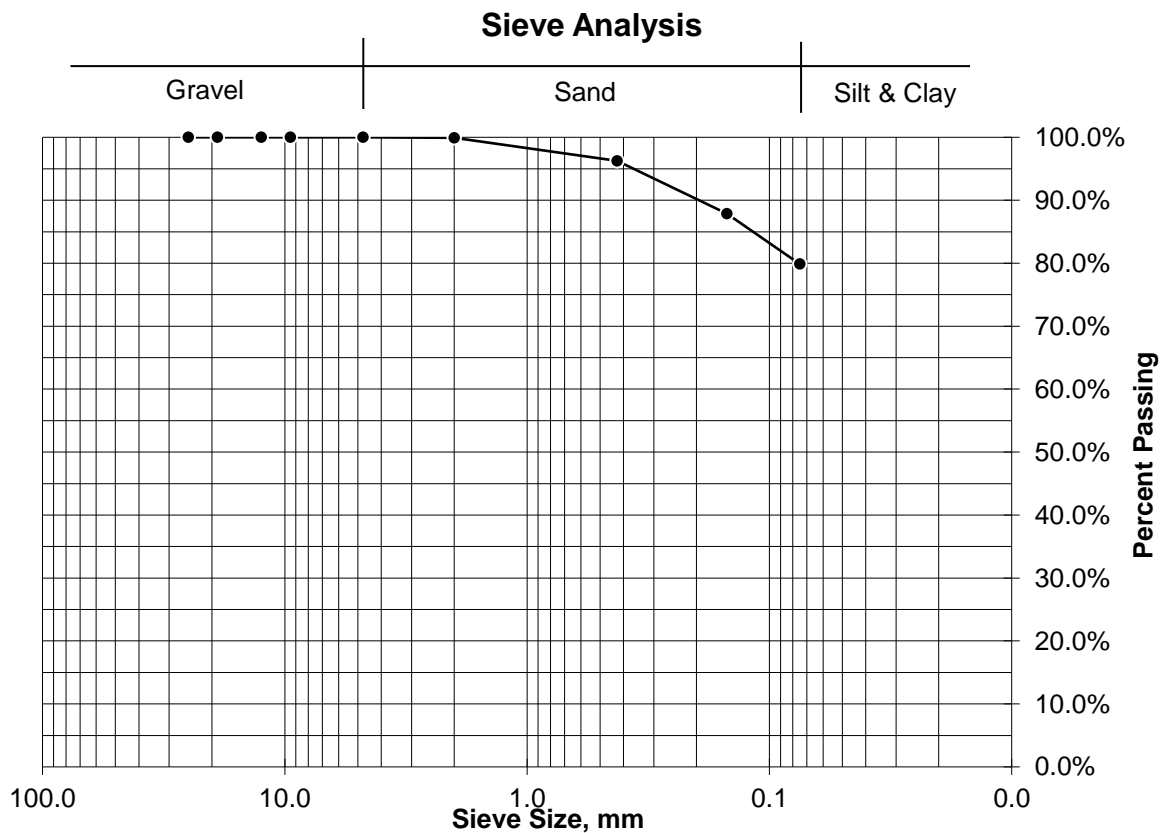


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.06	0.1%	2.00	99.9%
No. 40	2.79	3.6%	0.425	96.3%
No. 100	6.42	8.4%	0.15	87.9%
No. 200	6.13	8.0%	0.075	79.9%
Pan	0.25	0.3%		
Total	15.65	20.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Depth 20'-22'

Visual Sample Description Brownish-Gray Elastic SILT

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID 32
Pan Wt 191.70 grams
Pan + Soil (wet) 312.15 grams
Pan + Soil (dry) 272.30 grams
Natural Moisture Content 49.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 203.34 grams

Percent Passing No. 200 Sieve 85.6%

Pan + Soil retained on No. 4 sieve

(dry) 191.70 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	15	26	34
Pan ID	5	6	7
Pan Wt	11.04	11.17	11.10
Pan + Soil (wet)	26.52	28.70	25.05
Pan + Soil (dry)	19.86	21.56	19.59
Moisture Content	75.5%	68.7%	64.3%
Liquid Limit	71	69	67
<i>Liquid Limit</i>	69		

Plastic Limit

Pan ID	81	82
Pan Weight	4.33	4.24
Pan + Soil (wet)	15.52	16.80
Pan + Soil (dry)	12.13	12.93
Moisture Content	43.5%	44.5%
<i>Plastic Limit</i>	44	
<i>Plastic Index</i>	25	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-03

Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

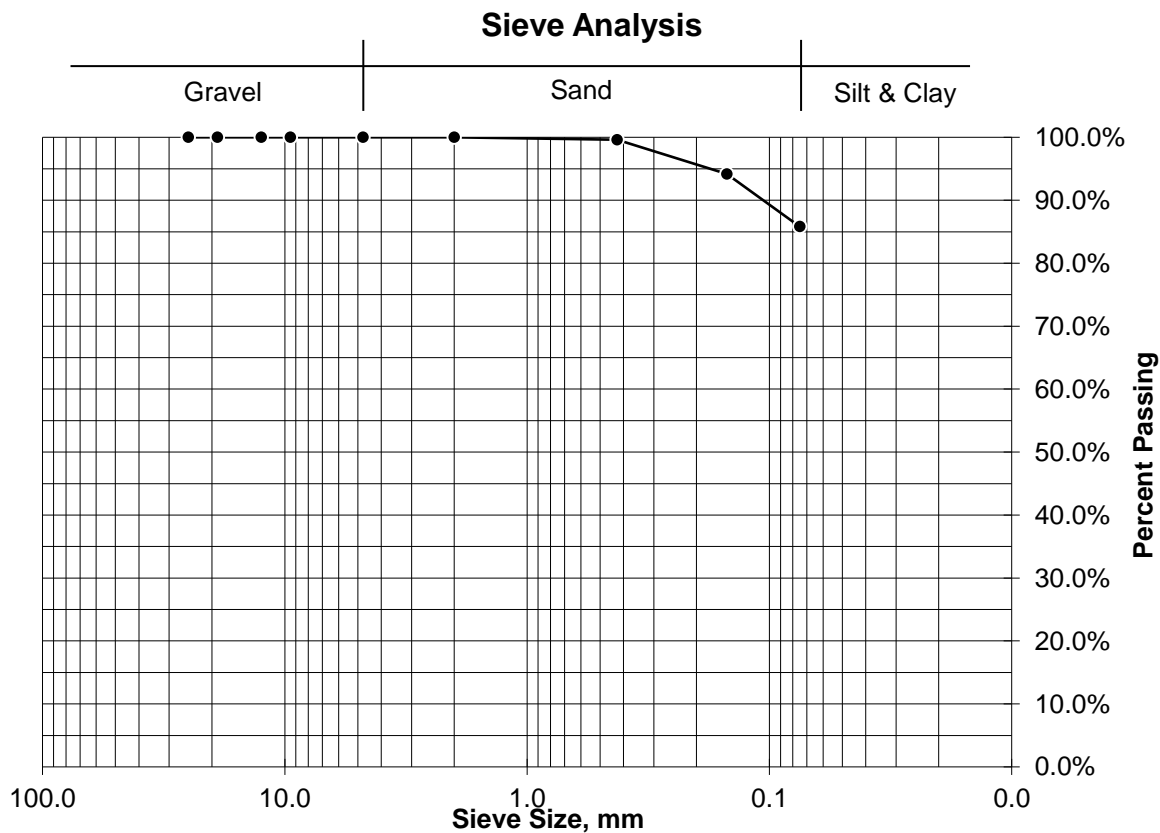


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	0.32	0.4%	0.425	99.6%
No. 100	4.37	5.4%	0.15	94.2%
No. 200	6.74	8.4%	0.075	85.8%
Pan	0.21	0.3%		
Total	11.64	14.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Received: 3/19/2019

Sample Depth 28'-30'

Date Tested: 3/19/2019

Visual Sample Description Light Brownish-Gray Elastic SILT with Sand

Natural Moisture Content: ASTM D 2216

Pan ID	9
Pan Wt	189.25 grams
Pan + Soil (wet)	306.75 grams
Pan + Soil (dry)	265.88 grams
Natural Moisture Content	53.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 206.13 grams

Percent Passing No. 200 Sieve 78.0%

Pan + Soil retained on No. 4 sieve

(dry) 189.25 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	16	26	34
Pan ID	10	70	72
Pan Wt	11.20	10.97	11.03
Pan + Soil (wet)	26.48	25.54	28.67
Pan + Soil (dry)	19.73	19.43	21.49
Moisture Content	79.2%	72.2%	68.6%
Liquid Limit	75	73	71
Liquid Limit	73		

Plastic Limit

Pan ID	313	316
Pan Weight	9.14	9.06
Pan + Soil (wet)	21.79	21.72
Pan + Soil (dry)	18.12	18.00
Moisture Content	40.9%	41.6%
Plastic Limit	41	
Plastic Index	32	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT with Sand**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

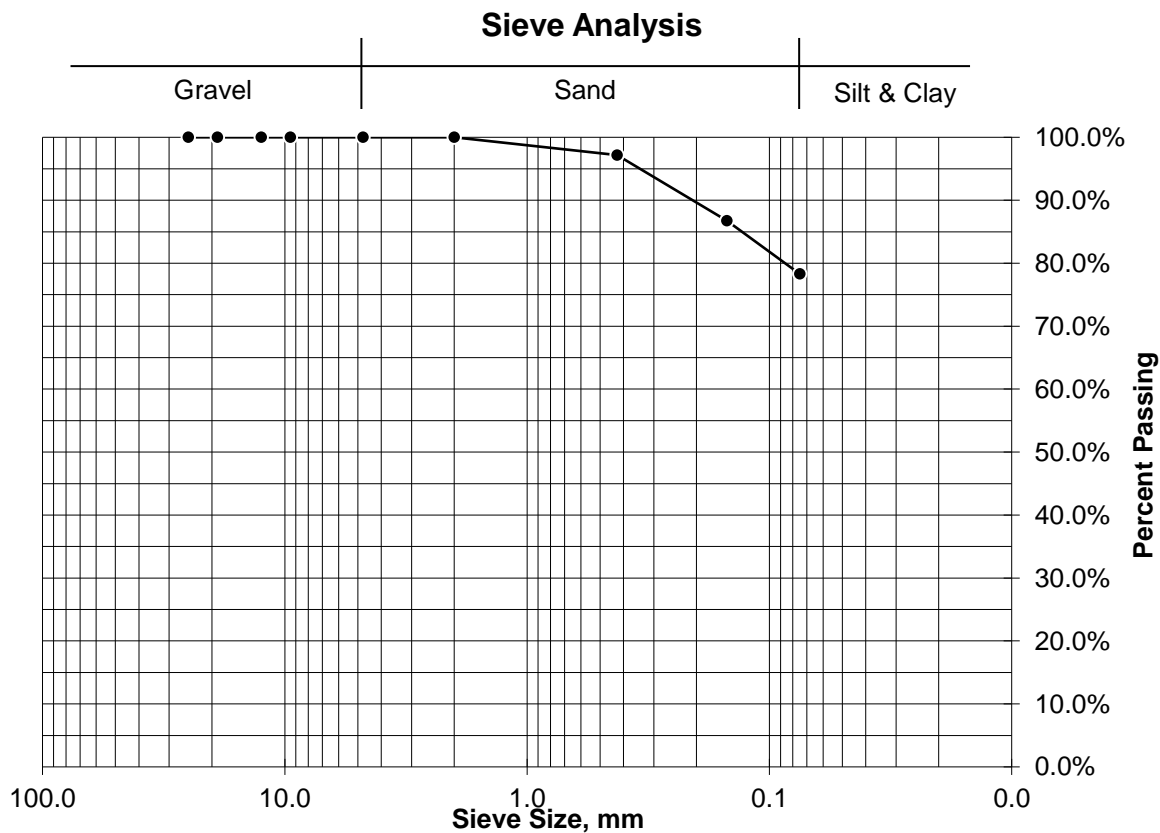
DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-03
Sample Depth 28'-30'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	2.16	2.8%	0.425	97.2%
No. 100	8.00	10.4%	0.15	86.7%
No. 200	6.47	8.4%	0.075	78.3%
Pan	0.25	0.3%		
Total	16.88	22.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Depth 45'-47'

Visual Sample Description Brownish-gray Elastic SILT with Sand

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	101
Pan Wt	122.76 grams
Pan + Soil (wet)	246.78 grams
Pan + Soil (dry)	204.71 grams
Natural Moisture Content	51.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 143.75 grams

Percent Passing No. 200 Sieve 74.4%

Pan + Soil retained on No. 4 sieve

(dry) 122.76 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/2/2019

Liquid Limit

No of Blows	18	21	33
Pan ID	101	105	107
Pan Wt	24.02	29.28	25.11
Pan + Soil (wet)	46.76	58.97	43.98
Pan + Soil (dry)	38.20	48.17	37.49
Moisture Content	60.4%	57.2%	52.4%
Liquid Limit	58	56	54
Liquid Limit	56		

Plastic Limit

Pan ID	75	78
Pan Weight	4.26	4.24
Pan + Soil (wet)	15.29	15.10
Pan + Soil (dry)	12.50	12.35
Moisture Content	33.8%	33.9%
Plastic Limit	34	
Plastic Index	22	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT with Sand

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-03

Sample Depth 45'-47'

Mechanical Sieve Analysis: ASTM D 422

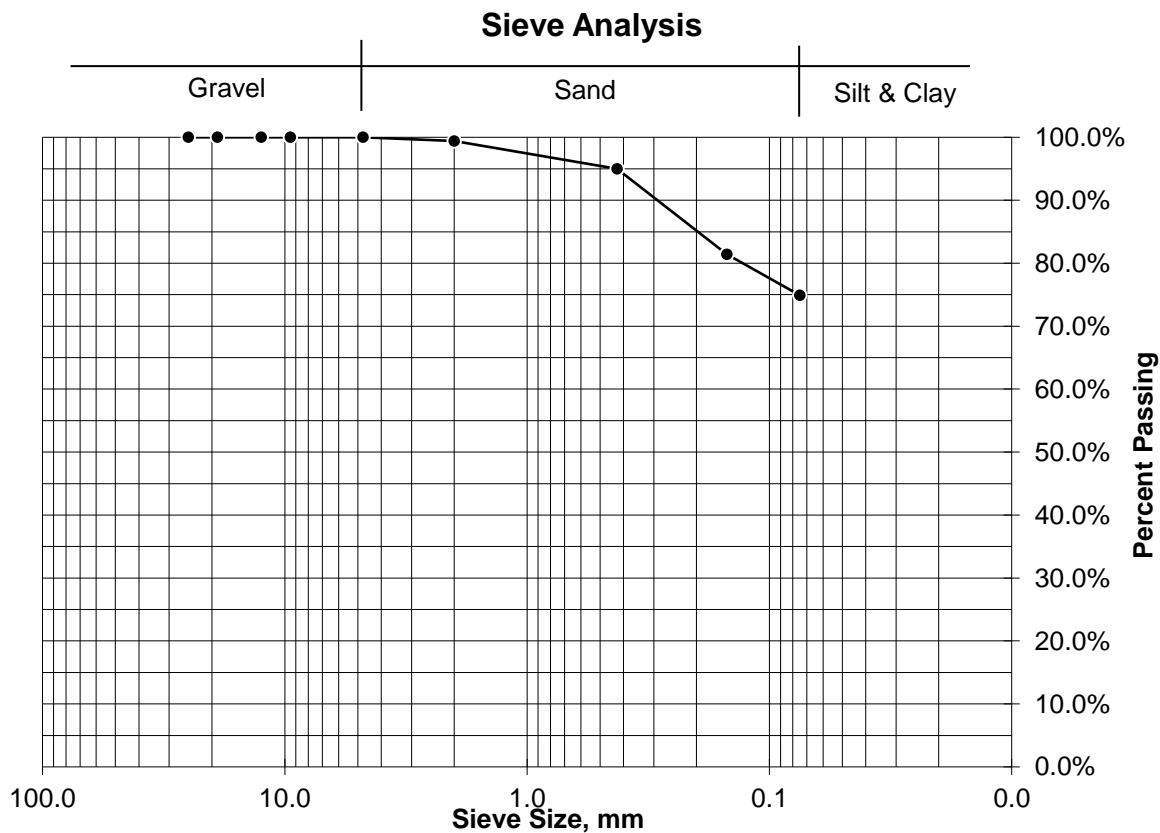


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.50	0.6%	2.00	99.4%
No. 40	3.62	4.4%	0.425	95.0%
No. 100	11.10	13.5%	0.15	81.4%
No. 200	5.34	6.5%	0.075	74.9%
Pan	0.42	0.5%		
Total	20.98	25.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-03

Sample Depth 55'-57'

Visual Sample Description Brown Sandy Elastic SILT

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	25
Pan Wt	194.02 grams
Pan + Soil (wet)	294.69 grams
Pan + Soil (dry)	264.26 grams
Natural Moisture Content	43.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 215.15 grams

Percent Passing No. 200 Sieve 69.9%

Pan + Soil retained on No. 4 sieve

(dry) 194.02 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	15	24	35
Pan ID	102	92	2000
Pan Wt	23.99	25.64	25.72
Pan + Soil (wet)	44.19	43.75	44.08
Pan + Soil (dry)	35.93	36.76	37.31
Moisture Content	69.1%	62.9%	58.4%
Liquid Limit	65	63	61
Liquid Limit	63		

Plastic Limit

Pan ID	314	317
Pan Weight	9.13	8.07
Pan + Soil (wet)	21.53	22.12
Pan + Soil (dry)	18.30	18.56
Moisture Content	35.2%	33.9%
Plastic Limit	35	
Plastic Index	28	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-03

Sample Depth 55'-57'

Mechanical Sieve Analysis: ASTM D 422

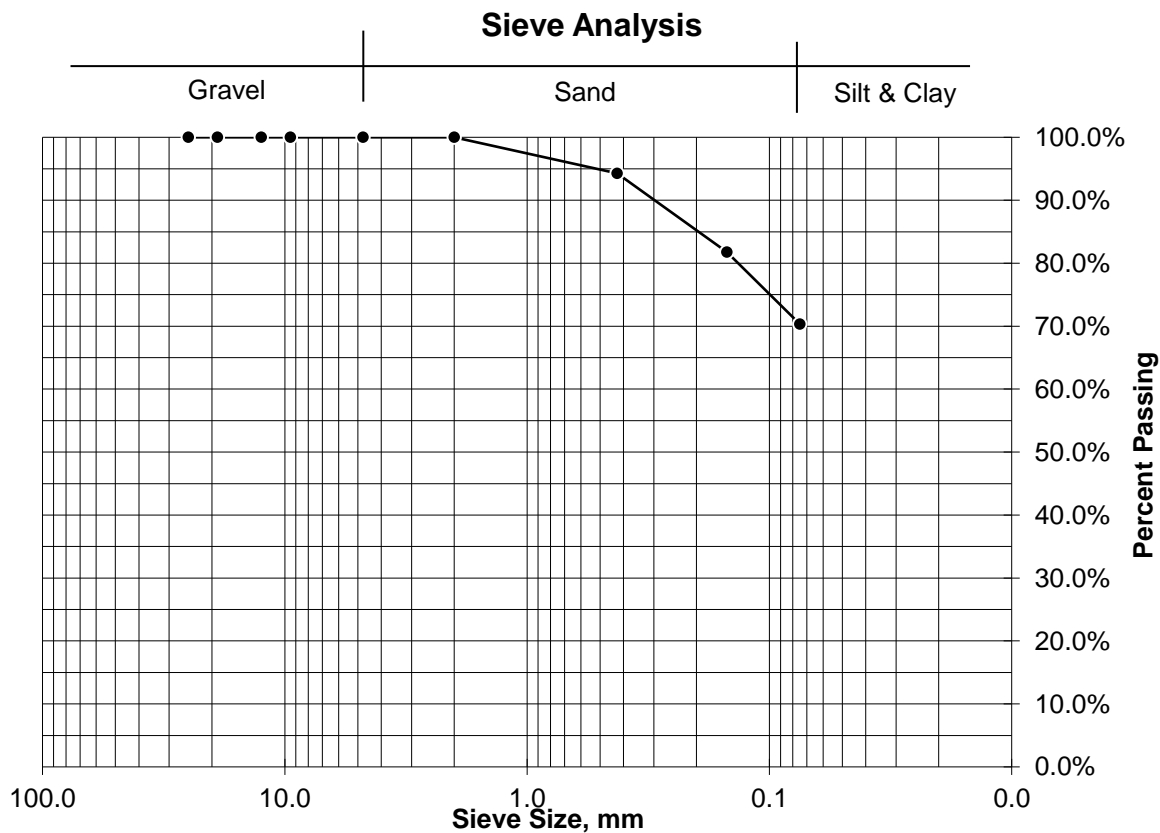


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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	4.01	5.7%	0.425	94.3%
No. 100	8.80	12.5%	0.15	81.8%
No. 200	8.01	11.4%	0.075	70.4%
Pan	0.29	0.4%		
Total	21.11	30.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-04

Sample Received: 3/19/2019

Sample Depth 10'-12'

Date Tested: 3/19/2019

Visual Sample Description Miaceous Light Brownish-Gray Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	40
Pan Wt	192.70 grams
Pan + Soil (wet)	298.16 grams
Pan + Soil (dry)	265.91 grams
Natural Moisture Content	44.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 234.75 grams

Percent Passing No. 200 Sieve 42.6%

Pan + Soil retained on No. 4 sieve

(dry) 192.70 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	18	25	33
Pan ID	61	71	1
Pan Wt	10.95	10.92	11.23
Pan + Soil (wet)	23.05	22.82	21.86
Pan + Soil (dry)	19.13	19.19	18.79
Moisture Content	47.9%	43.9%	40.6%
Liquid Limit	46	44	42
Liquid Limit	44		

Plastic Limit

Pan ID	0	1138
Pan Weight	6.07	6.14
Pan + Soil (wet)	16.17	16.93
Pan + Soil (dry)	13.71	14.26
Moisture Content	32.2%	32.9%
Plastic Limit	33	
Plastic Index	11	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 10'-12'

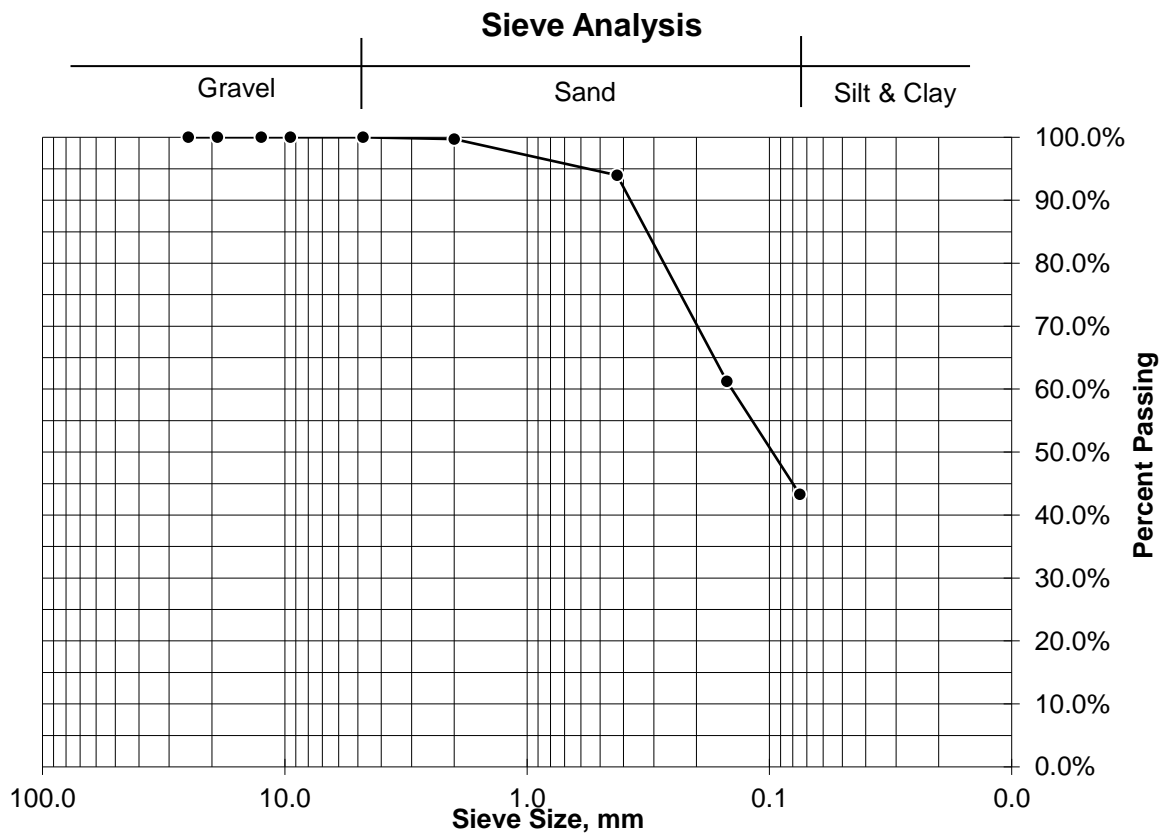
Mechanical Sieve Analysis: ASTM D 422



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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.22	0.3%	2.00	99.7%
No. 40	4.21	5.8%	0.425	93.9%
No. 100	23.94	32.7%	0.15	61.2%
No. 200	13.13	17.9%	0.075	43.3%
Pan	0.53	0.7%		
Total	42.03	57.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-04

Sample Depth 12'-14'

Visual Sample Description Light Reddish-Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	23
Pan Wt	193.95 grams
Pan + Soil (wet)	330.26 grams
Pan + Soil (dry)	296.59 grams
Natural Moisture Content	32.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 262.13 grams

Percent Passing No. 200 Sieve 33.6%

Pan + Soil retained on No. 4 sieve

(dry) 193.95 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 12'-14'

Mechanical Sieve Analysis: ASTM D 422

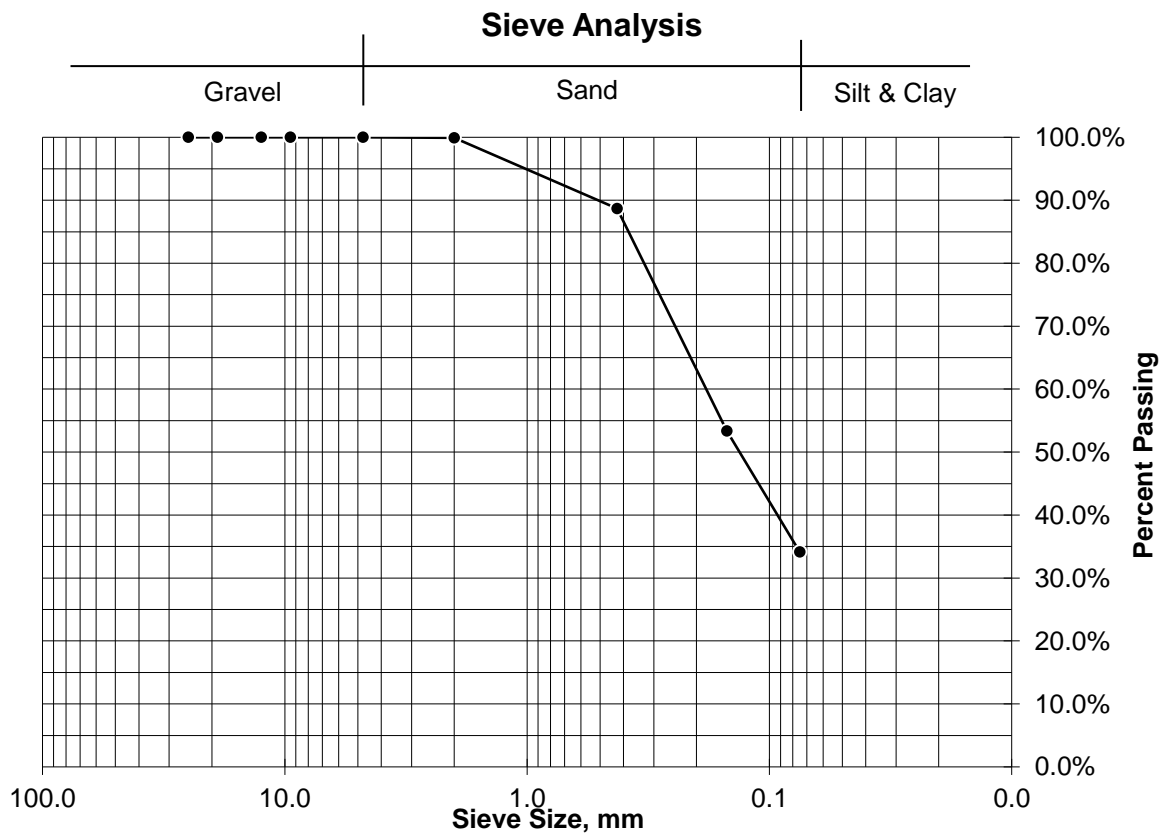


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.10	0.1%	2.00	99.9%
No. 40	11.51	11.2%	0.425	88.7%
No. 100	36.26	35.3%	0.15	53.4%
No. 200	19.72	19.2%	0.075	34.1%
Pan	0.58	0.6%		
Total	68.17	66.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Army Corps of Engineers Certified Laboratory

Sample ID DAA-04

Sample Depth 18'-20'

Visual Sample Description Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	19
Pan Wt	188.56 grams
Pan + Soil (wet)	291.38 grams
Pan + Soil (dry)	257.20 grams
Natural Moisture Content	49.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 226.14 grams

Percent Passing No. 200 Sieve 45.3%

Pan + Soil retained on No. 4 sieve

(dry) 188.56 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	18	23	31
Pan ID	705	710	711
Pan Wt	11.57	11.51	11.58
Pan + Soil (wet)	30.27	31.37	32.83
Pan + Soil (dry)	23.54	24.50	25.84
Moisture Content	56.2%	52.9%	49.0%
Liquid Limit	54	52	50
Liquid Limit	52		

Plastic Limit

Pan ID	314	317
Pan Weight	9.15	8.08
Pan + Soil (wet)	23.17	21.93
Pan + Soil (dry)	19.04	17.84
Moisture Content	41.8%	41.9%
Plastic Limit	42	
Plastic Index	10	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 18'-20'

Mechanical Sieve Analysis: ASTM D 422

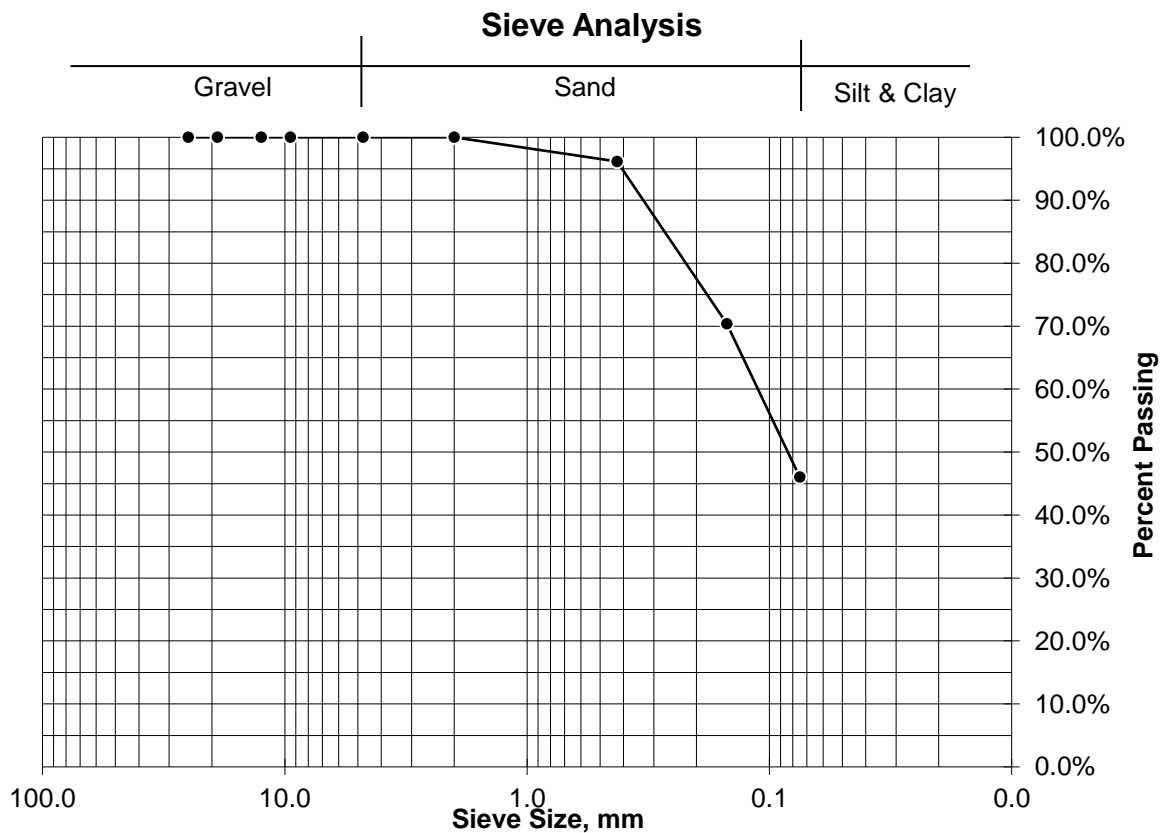


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	2.65	3.9%	0.425	96.1%
No. 100	17.67	25.7%	0.15	70.4%
No. 200	16.71	24.3%	0.075	46.1%
Pan	0.55	0.8%		
Total	37.58	54.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-04

Sample Depth 24'-26'

Visual Sample Description Light Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	5
Pan Wt	192.72 grams
Pan + Soil (wet)	295.14 grams
Pan + Soil (dry)	267.88 grams
Natural Moisture Content	36.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 244.49 grams

Percent Passing No. 200 Sieve 31.1%

Pan + Soil retained on No. 4 sieve

(dry) 192.89 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

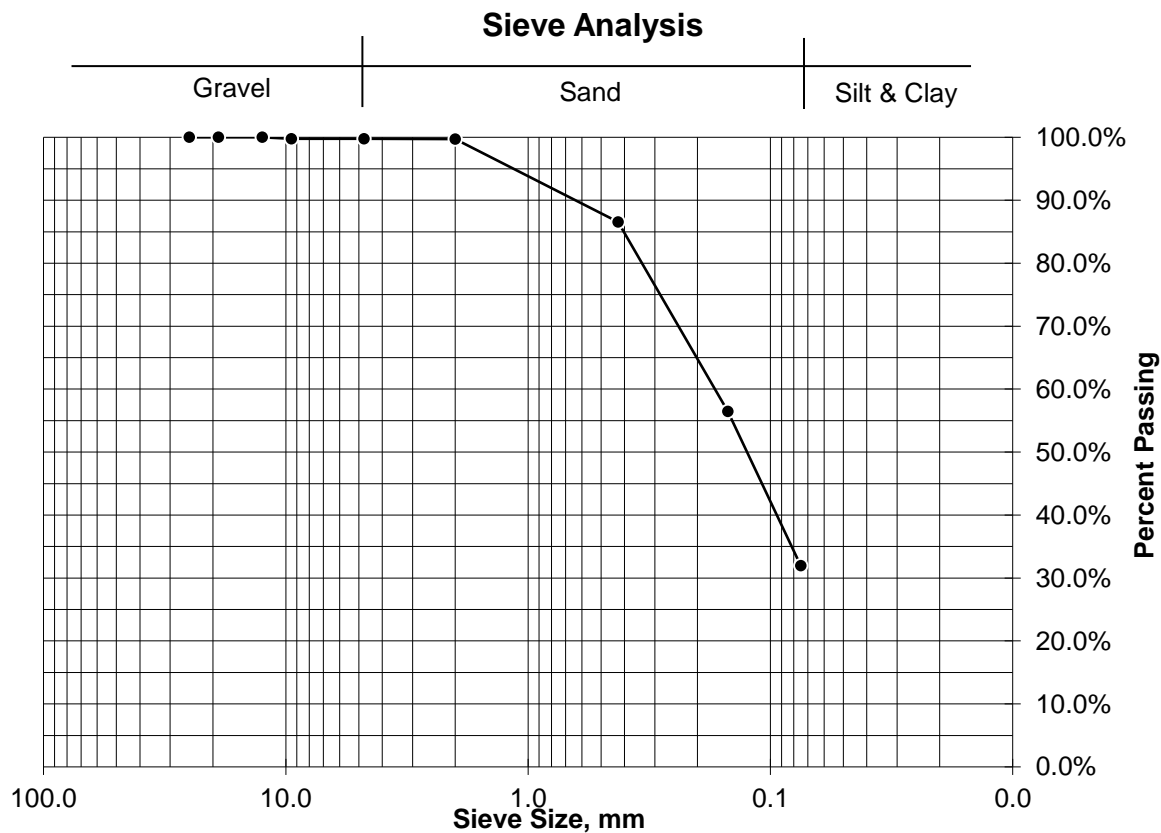


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.17	0.2%	9.50	99.8%
No. 4	0.00	0.0%	4.75	99.8%
No. 10	0.05	0.1%	2.00	99.7%
No. 40	9.90	13.2%	0.425	86.5%
No. 100	22.60	30.1%	0.15	56.5%
No. 200	18.40	24.5%	0.075	32.0%
Pan	0.61	0.8%		
Total	51.73	68.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Army Corps of Engineers Certified Laboratory

Sample ID DAA-04

Sample Depth 28'-30'

Visual Sample Description Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	17
Pan Wt	188.64 grams
Pan + Soil (wet)	303.75 grams
Pan + Soil (dry)	275.02 grams
Natural Moisture Content	33.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 242.56 grams

Percent Passing No. 200 Sieve 37.6%

Pan + Soil retained on No. 4 sieve

(dry) 188.64 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	17	26	34
Pan ID	92	102	2000
Pan Wt	25.65	24.02	25.71
Pan + Soil (wet)	48.43	42.15	44.60
Pan + Soil (dry)	41.33	36.89	39.45
Moisture Content	45.3%	40.9%	37.5%
Liquid Limit	43	41	39
Liquid Limit	41		

Plastic Limit

Pan ID	22	75
Pan Weight	4.33	4.27
Pan + Soil (wet)	20.34	17.45
Pan + Soil (dry)	16.30	14.05
Moisture Content	33.8%	34.8%
Plastic Limit	34	
Plastic Index	7	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 28'-30'

Mechanical Sieve Analysis: ASTM D 422

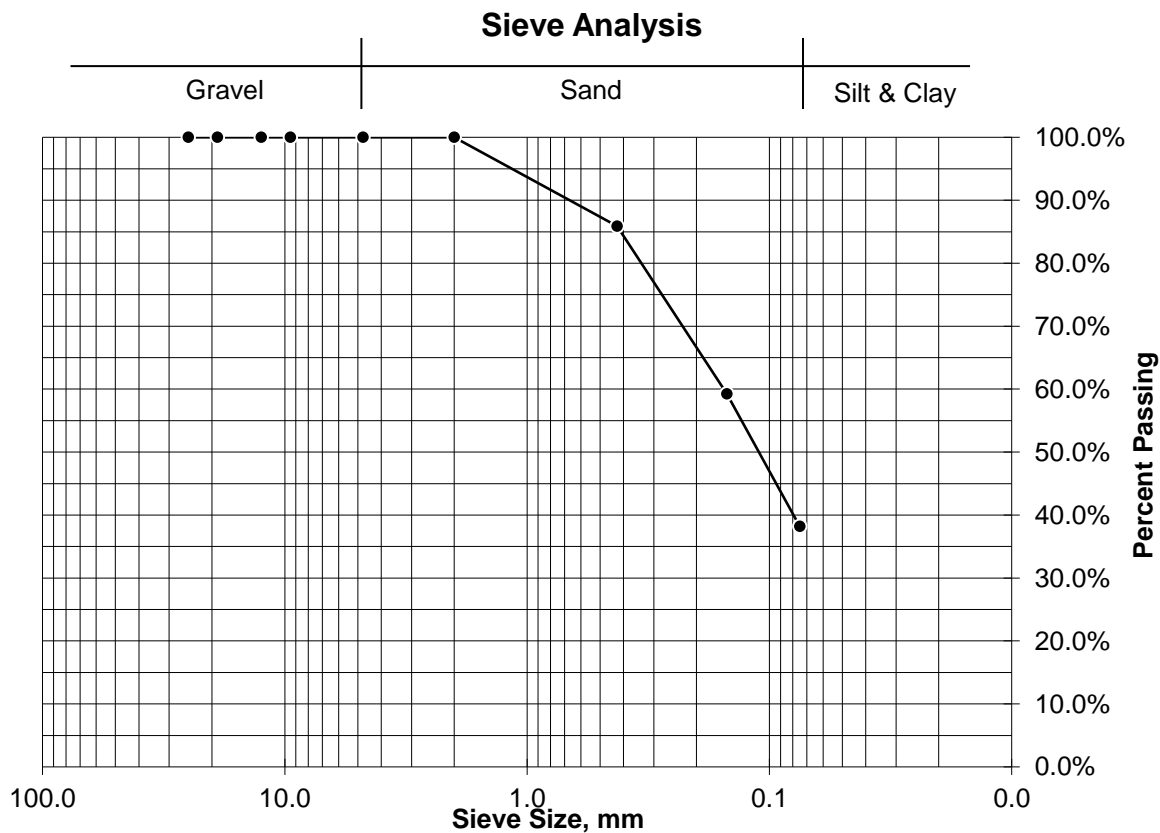


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	12.20	14.1%	0.425	85.9%
No. 100	22.98	26.6%	0.15	59.3%
No. 200	18.19	21.1%	0.075	38.2%
Pan	0.55	0.6%		
Total	53.92	62.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-04

Sample Depth 36'-38'

Visual Sample Description Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	42
Pan Wt	192.28 grams
Pan + Soil (wet)	296.27 grams
Pan + Soil (dry)	274.70 grams
Natural Moisture Content	26.2%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 249.52 grams

Percent Passing No. 200 Sieve 30.6%

Pan + Soil retained on No. 4 sieve

(dry) 192.28 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-04

Sample Depth 36'-38'

Mechanical Sieve Analysis: ASTM D 422

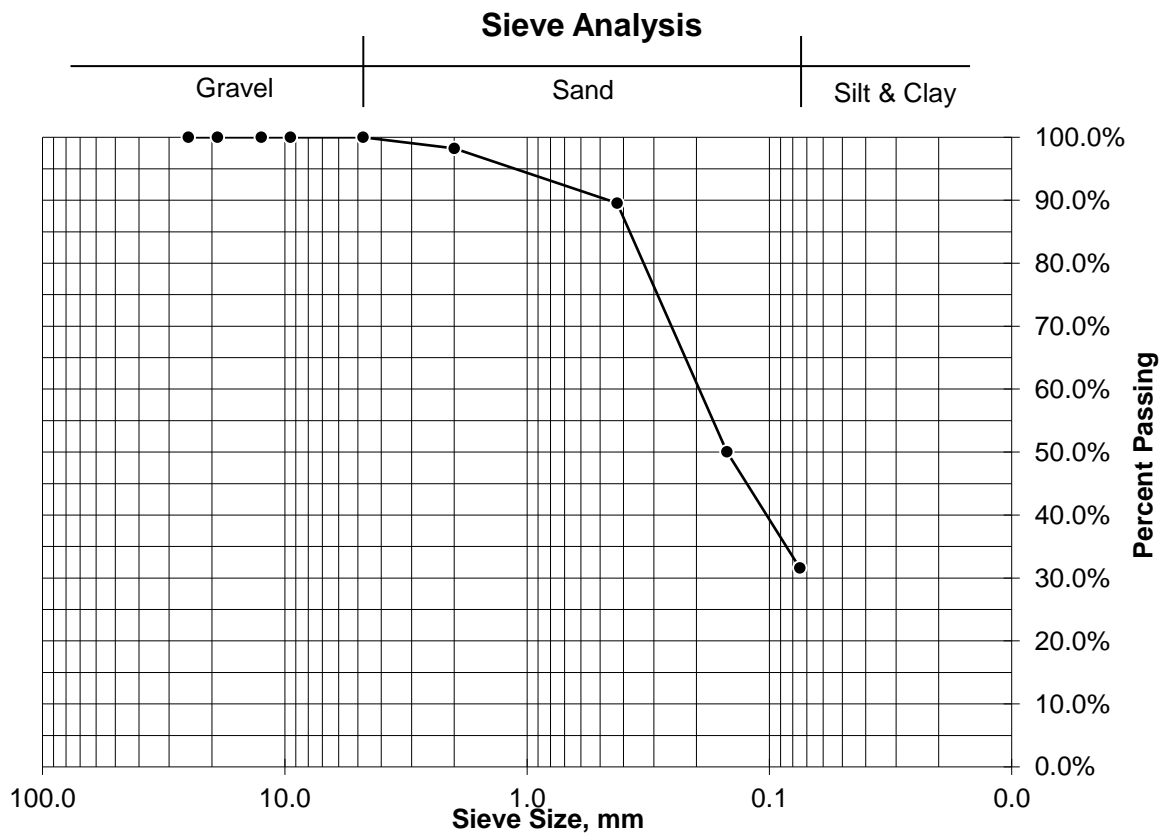


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.44	1.7%	2.00	98.3%
No. 40	7.17	8.7%	0.425	89.6%
No. 100	32.57	39.5%	0.15	50.0%
No. 200	15.17	18.4%	0.075	31.6%
Pan	0.87	1.1%		
Total	57.22	69.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-05

Sample Depth 7'-9'

Visual Sample Description Light Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	24
Pan Wt	186.11 grams
Pan + Soil (wet)	314.11 grams
Pan + Soil (dry)	305.66 grams
Natural Moisture Content	7.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 285.82 grams

Percent Passing No. 200 Sieve 16.6%

Pan + Soil retained on No. 4 sieve

(dry) 186.11 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/19/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)	Non-plastic	
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-05

Sample Depth 7'-9'

Mechanical Sieve Analysis: ASTM D 422

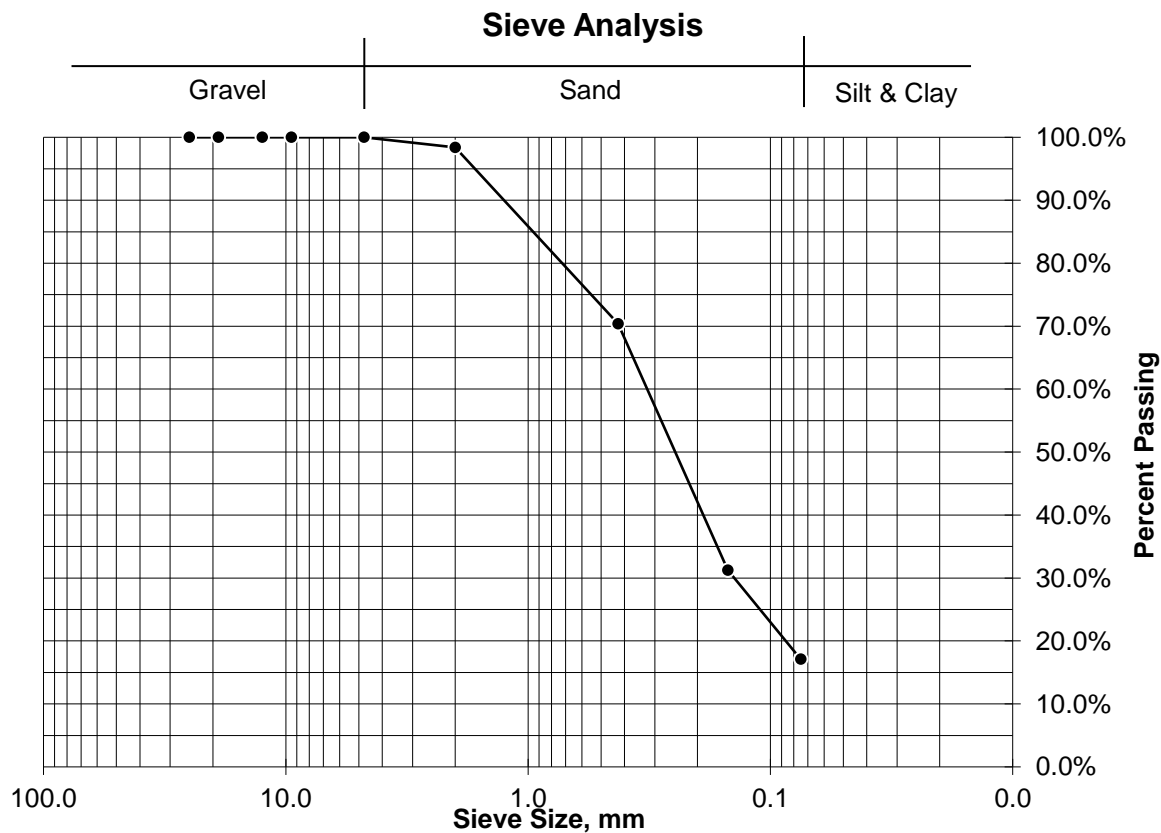


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.90	1.6%	2.00	98.4%
No. 40	33.50	28.0%	0.425	70.4%
No. 100	46.78	39.1%	0.15	31.3%
No. 200	16.92	14.2%	0.075	17.1%
Pan	0.60	0.5%		
Total	99.70	83.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Richmond, VA 23227

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Sample ID DAA-05

Sample Depth 15'-17'

Visual Sample Description Light Brownish-Red Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	1
Pan Wt	195.45 grams
Pan + Soil (wet)	301.00 grams
Pan + Soil (dry)	293.74 grams
Natural Moisture Content	7.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 275.64 grams

Percent Passing No. 200 Sieve 18.4%

Pan + Soil retained on No. 4 sieve

(dry) 195.61 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/19/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)	Non-plastic	
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-05

Sample Depth 15'-17'

Mechanical Sieve Analysis: ASTM D 422

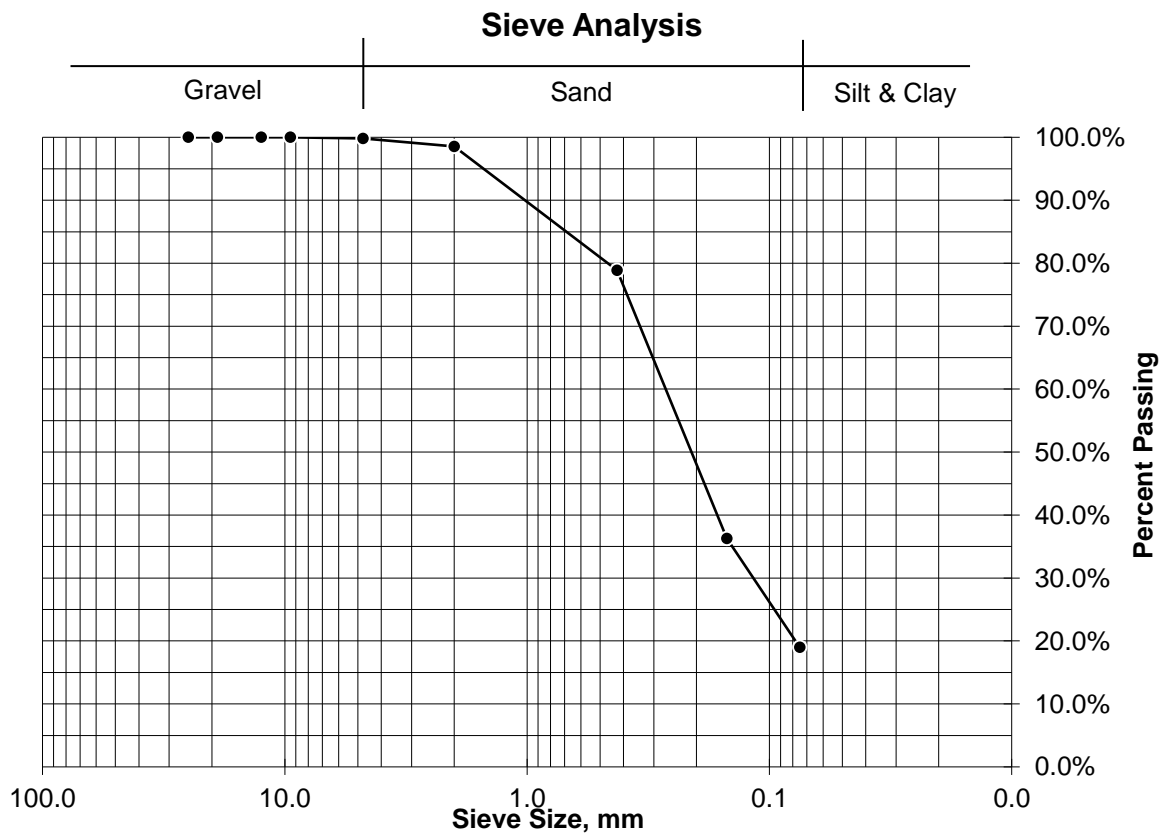


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.16	0.2%	4.75	99.8%
No. 10	1.28	1.3%	2.00	98.5%
No. 40	19.31	19.6%	0.425	78.9%
No. 100	41.90	42.6%	0.15	36.3%
No. 200	16.96	17.3%	0.075	19.0%
Pan	0.57	0.6%		
Total	80.18	81.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-06

Sample Depth 12'-14'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	10
Pan Wt	184.04 grams
Pan + Soil (wet)	298.73 grams
Pan + Soil (dry)	293.47 grams
Natural Moisture Content	4.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 274.71 grams

Percent Passing No. 200 Sieve 17.1%

Pan + Soil retained on No. 4 sieve

(dry) 184.04 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/19/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)	Non-plastic	
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-06

Sample Depth 12'-14'

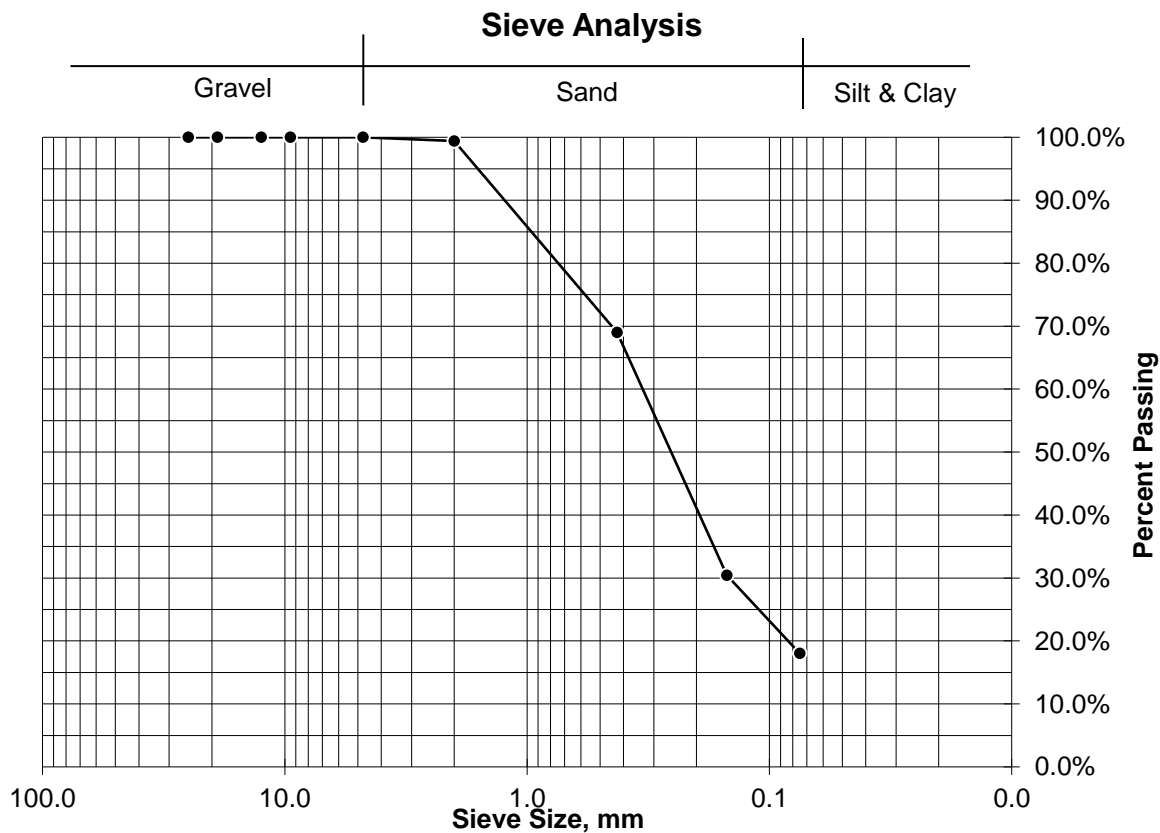
Mechanical Sieve Analysis: ASTM D 422



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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.67	0.6%	2.00	99.4%
No. 40	33.23	30.4%	0.425	69.0%
No. 100	42.24	38.6%	0.15	30.4%
No. 200	13.55	12.4%	0.075	18.0%
Pan	0.96	0.9%		
Total	90.65	82.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-07

Sample Depth 10'-12'

Visual Sample Description Brownish-gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	30
Pan Wt	193.24 grams
Pan + Soil (wet)	300.01 grams
Pan + Soil (dry)	275.97 grams
Natural Moisture Content	29.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 250.28 grams

Percent Passing No. 200 Sieve 31.1%

Pan + Soil retained on No. 4 sieve

(dry) 193.24 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	15	23	35
Pan ID	105	107	201
Pan Wt	29.29	25.13	27.70
Pan + Soil (wet)	49.71	42.20	50.08
Pan + Soil (dry)	41.92	36.00	42.44
Moisture Content	61.7%	57.0%	51.8%
Liquid Limit	58	56	54
Liquid Limit	56		

Plastic Limit

Pan ID	352	354
Pan Weight	9.13	9.19
Pan + Soil (wet)	20.33	20.54
Pan + Soil (dry)	17.50	17.67
Moisture Content	33.8%	33.9%
Plastic Limit	34	
Plastic Index	22	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-07

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

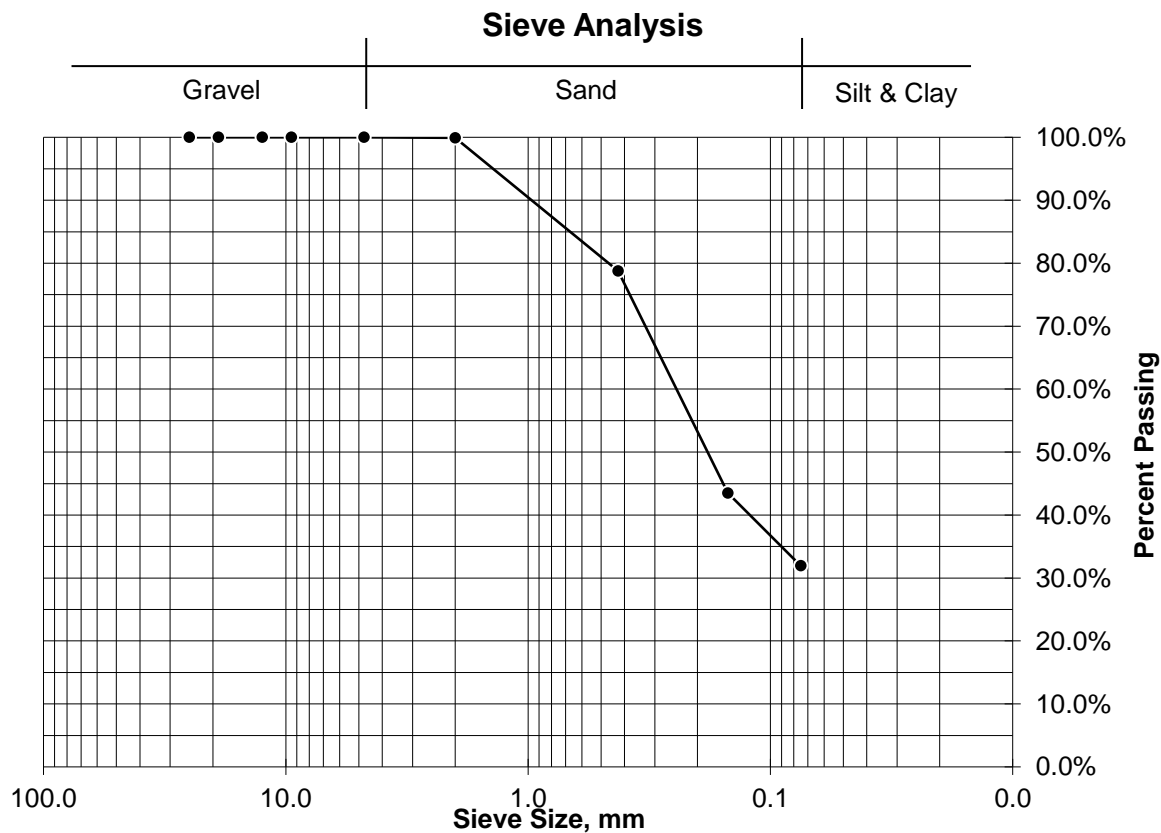


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.08	0.1%	2.00	99.9%
No. 40	17.50	21.2%	0.425	78.8%
No. 100	29.16	35.2%	0.15	43.5%
No. 200	9.56	11.6%	0.075	31.9%
Pan	0.73	0.9%		
Total	57.03	68.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-07

Sample Depth 14'-16'

Visual Sample Description Micaceous Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	26
Pan Wt	194.56 grams
Pan + Soil (wet)	309.39 grams
Pan + Soil (dry)	286.88 grams
Natural Moisture Content	24.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 263.01 grams

Percent Passing No. 200 Sieve 25.9%

Pan + Soil retained on No. 4 sieve

(dry) 194.56 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	17	28	35
Pan ID	70	9	65
Pan Wt	11.00	11.15	10.99
Pan + Soil (wet)	22.48	21.98	23.37
Pan + Soil (dry)	18.97	18.94	20.06
Moisture Content	44.0%	39.0%	36.5%
Liquid Limit	42	40	38
Liquid Limit	40		

Plastic Limit

Pan ID	84	83
Pan Weight	4.29	4.22
Pan + Soil (wet)	15.22	15.73
Pan + Soil (dry)	12.83	13.20
Moisture Content	28.0%	28.2%
Plastic Limit	28	
Plastic Index	12	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-07

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

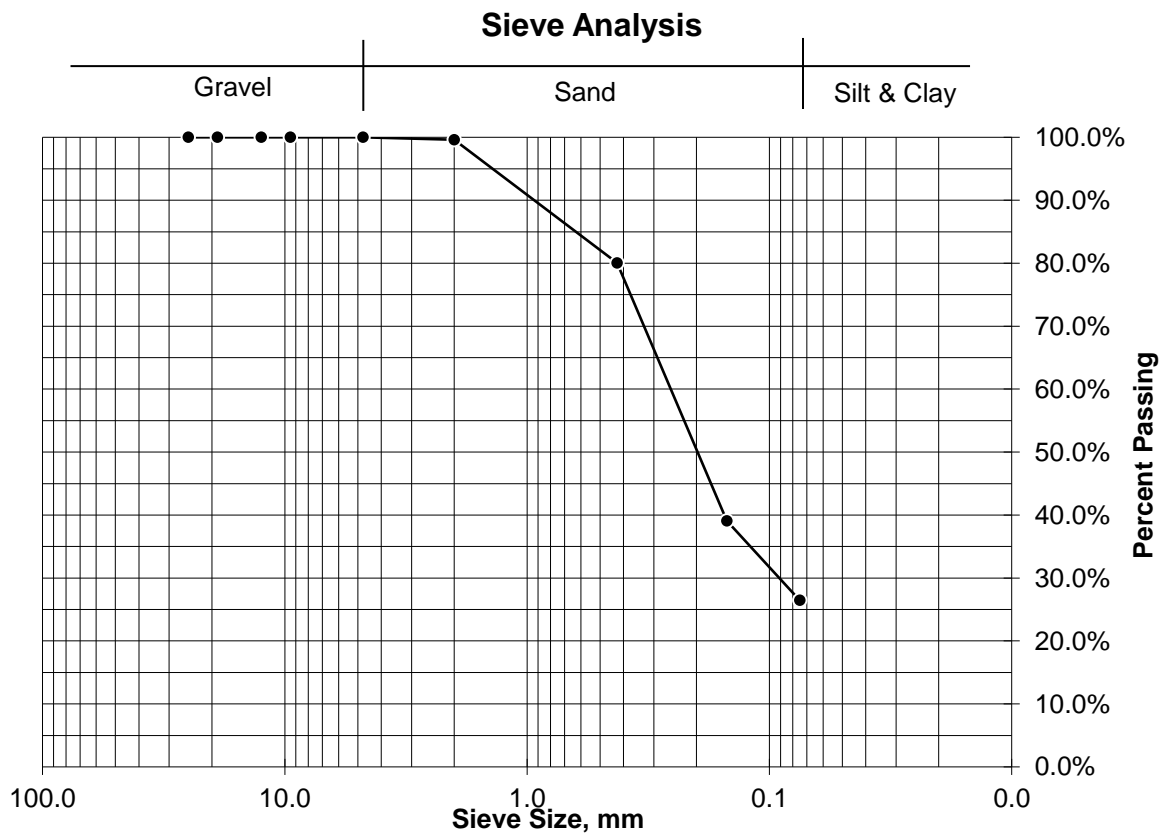


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Richmond, VA 23227

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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.35	0.4%	2.00	99.6%
No. 40	18.09	19.6%	0.425	80.0%
No. 100	37.80	40.9%	0.15	39.1%
No. 200	11.64	12.6%	0.075	26.5%
Pan	0.54	0.6%		
Total	68.42	74.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-07

Sample Depth 55'-57'

Visual Sample Description Dark Reddish-Brown Sandy Elastic SILT

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	7
Pan Wt	192.36 grams
Pan + Soil (wet)	300.83 grams
Pan + Soil (dry)	263.58 grams
Natural Moisture Content	52.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 224.65 grams

Percent Passing No. 200 Sieve 54.7%

Pan + Soil retained on No. 4 sieve

(dry) 192.36 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	15	26	34
Pan ID	91	93	98
Pan Wt	24.48	30.02	30.33
Pan + Soil (wet)	39.70	51.63	45.57
Pan + Soil (dry)	33.71	43.60	40.18
Moisture Content	64.9%	59.1%	54.7%
Liquid Limit	61	59	57
Liquid Limit	59		

Plastic Limit

Pan ID	22	84
Pan Weight	4.26	4.27
Pan + Soil (wet)	15.82	15.11
Pan + Soil (dry)	12.33	11.81
Moisture Content	43.2%	43.8%
Plastic Limit	44	
Plastic Index	15	

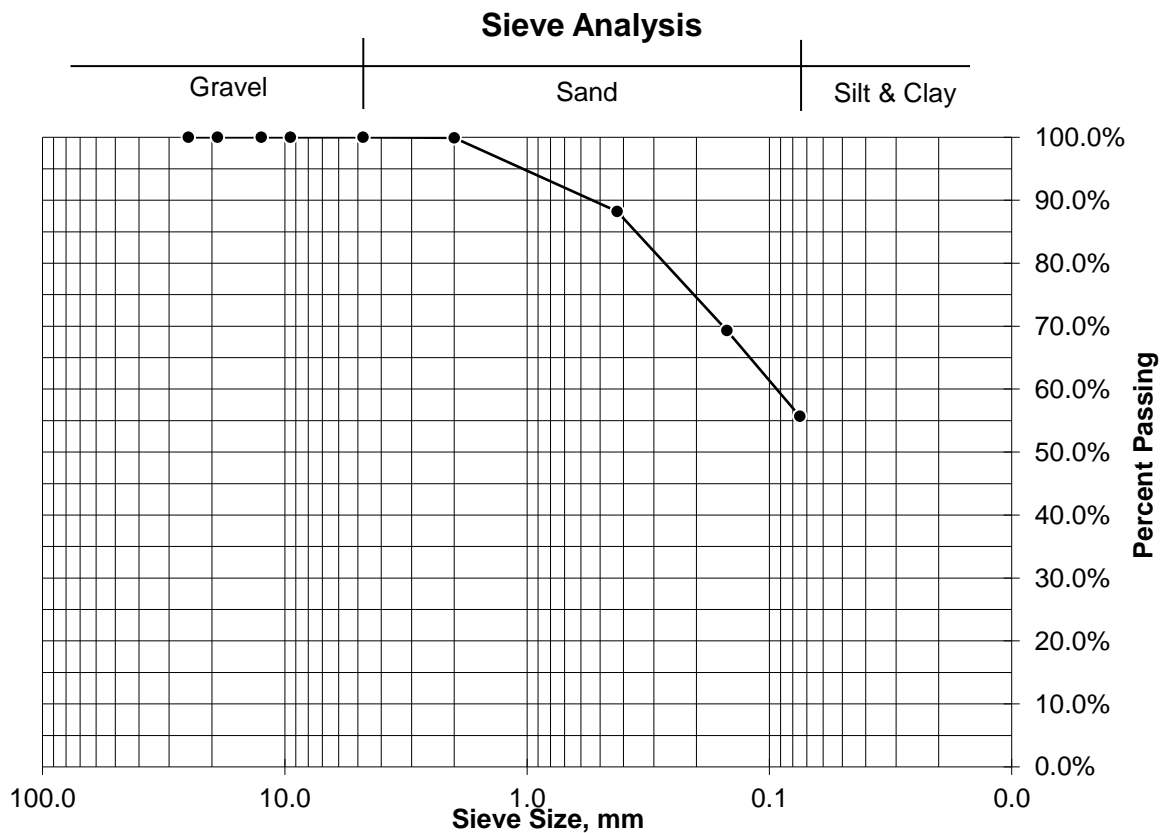
USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Prepared By: CBW

Sample Depth 55'-57'



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-08

Sample Depth 6'-8'

Visual Sample Description Reddish-Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	6
Pan Wt	195.41 grams
Pan + Soil (wet)	306.06 grams
Pan + Soil (dry)	278.78 grams
Natural Moisture Content	32.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 245.61 grams

Percent Passing No. 200 Sieve 39.8%

Pan + Soil retained on No. 4 sieve

(dry) 195.41 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	15	26	34
Pan ID	10	62	63
Pan Wt	11.20	10.85	10.81
Pan + Soil (wet)	28.75	27.80	27.63
Pan + Soil (dry)	22.27	21.93	22.09
Moisture Content	58.5%	53.0%	49.1%
Liquid Limit	55	53	51
Liquid Limit	53		

Plastic Limit

Pan ID	23	74
Pan Weight	4.34	4.26
Pan + Soil (wet)	15.71	15.31
Pan + Soil (dry)	12.03	11.73
Moisture Content	47.8%	47.9%
Plastic Limit	48	
Plastic Index	5	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

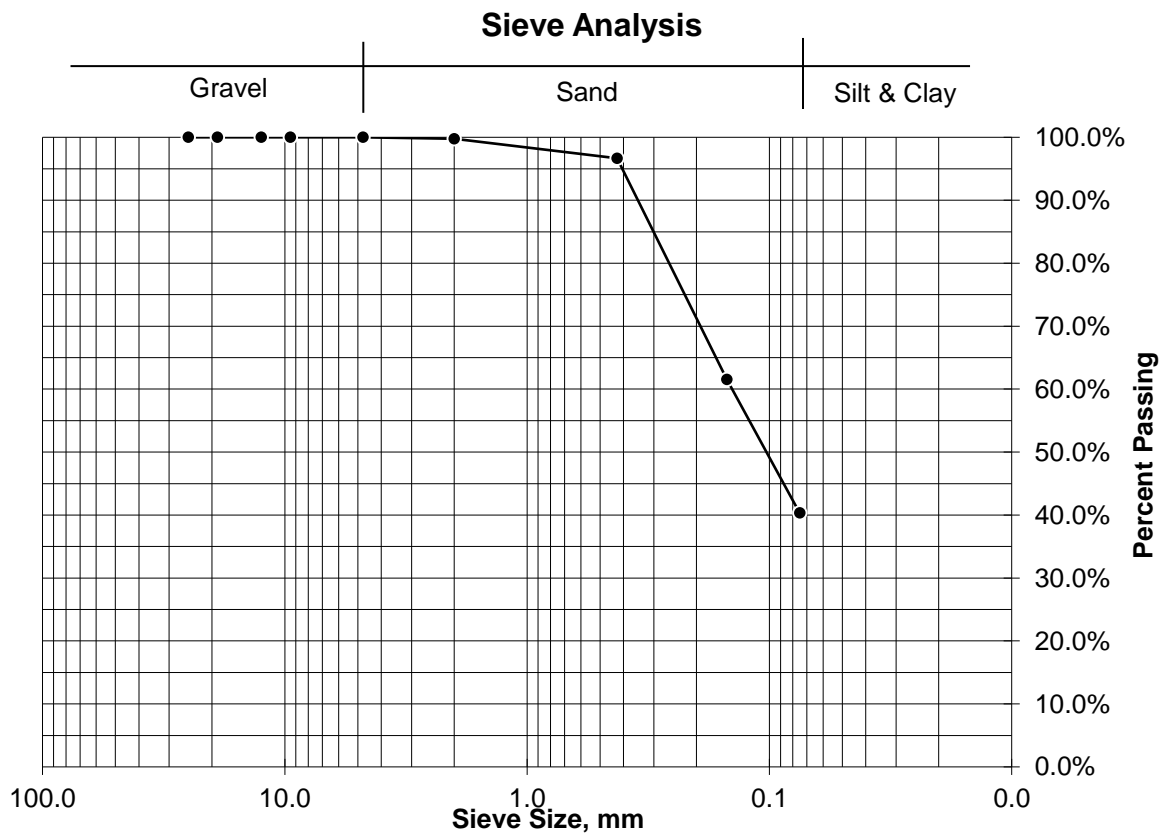
Prepared By: CBW

Sample ID DAA-08

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.21	0.3%	2.00	99.7%
No. 40	2.57	3.1%	0.425	96.7%
No. 100	29.28	35.1%	0.15	61.5%
No. 200	17.69	21.2%	0.075	40.3%
Pan	0.45	0.5%		
Total	50.20	60.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-08

Sample Depth 10'-11.5'

Visual Sample Description Gray Silty SAND

Sample Received: 4/26/2019

Date Tested: 4/26/2019

Natural Moisture Content: ASTM D 2216

Pan ID	35
Pan Wt	192.71 grams
Pan + Soil (wet)	485.76 grams
Pan + Soil (dry)	399.72 grams
Natural Moisture Content	41.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	341.96 grams
Percent Passing No. 200 Sieve	27.9%
Pan + Soil retained on No. 4 sieve	
(dry)	194.03 grams
Percent Passing No. 4 Sieve	99.4%
Soil Classifies as	Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

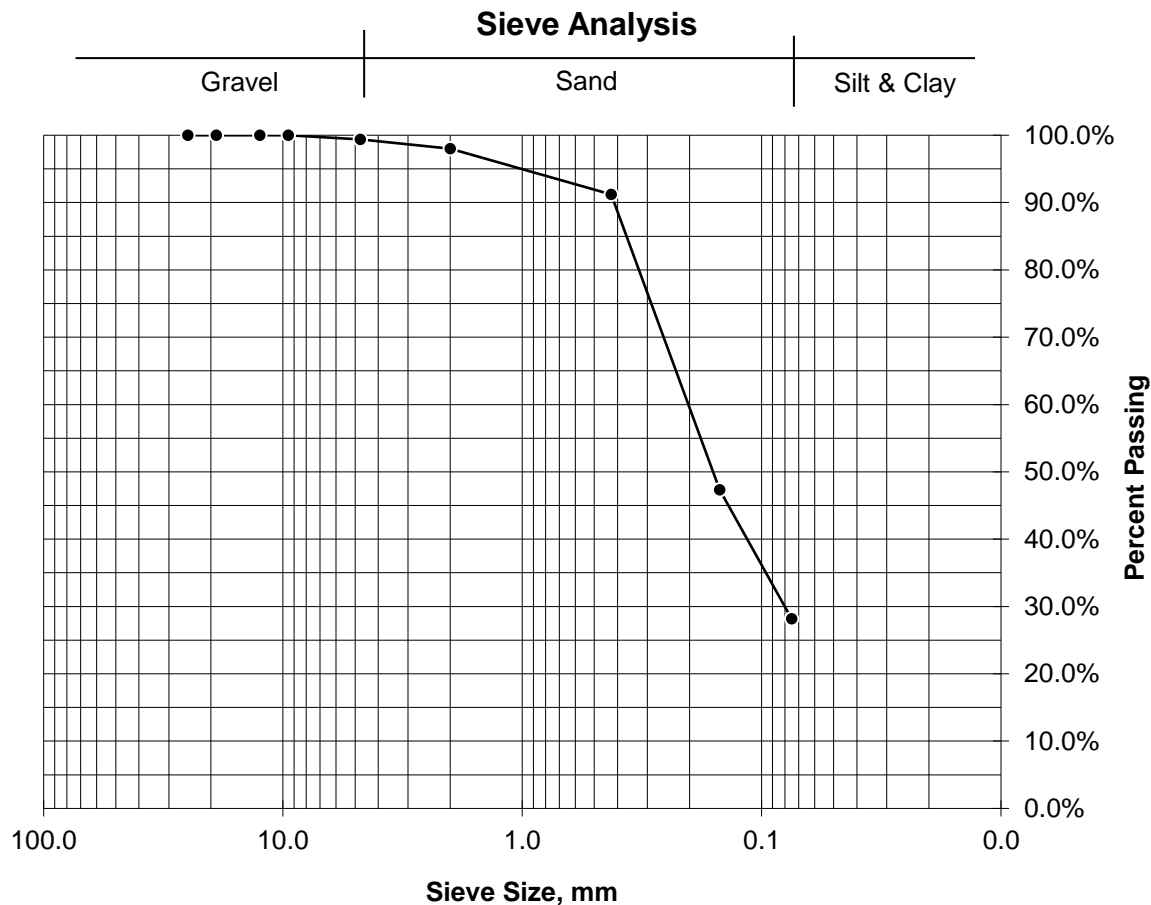
Prepared By: CBW

Sample ID DAA-08

Sample Depth 10'-11.5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Date Tested: Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	1.32	0.6%	4.75	99.4%
No. 10	2.77	1.3%	2.0	98.0%
No. 40	14.15	6.8%	0.425	91.2%
No. 100	90.77	43.8%	0.15	47.3%
No. 200	39.67	19.2%	0.075	28.2%
Pan	0.54	0.3%		
Total	149.22	72.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-08

Sample Depth 12'-14'

Visual Sample Description Micaceous Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	37
Pan Wt	193.55 grams
Pan + Soil (wet)	302.87 grams
Pan + Soil (dry)	269.55 grams
Natural Moisture Content	43.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 249.49 grams

Percent Passing No. 200 Sieve 26.4%

Pan + Soil retained on No. 4 sieve

(dry) 193.55 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	15	22	35
Pan ID	96	169	201
Pan Wt	24.82	27.15	27.65
Pan + Soil (wet)	41.90	45.82	47.45
Pan + Soil (dry)	36.35	40.19	41.86
Moisture Content	48.1%	43.2%	39.4%
Liquid Limit	45	43	41
Liquid Limit	43		

Plastic Limit

Pan ID	13	353
Pan Weight	4.28	9.12
Pan + Soil (wet)	17.45	22.46
Pan + Soil (dry)	13.97	18.94
Moisture Content	35.9%	35.8%
Plastic Limit	36	
Plastic Index	7	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-08

Sample Depth 12'-14'

Mechanical Sieve Analysis: ASTM D 422

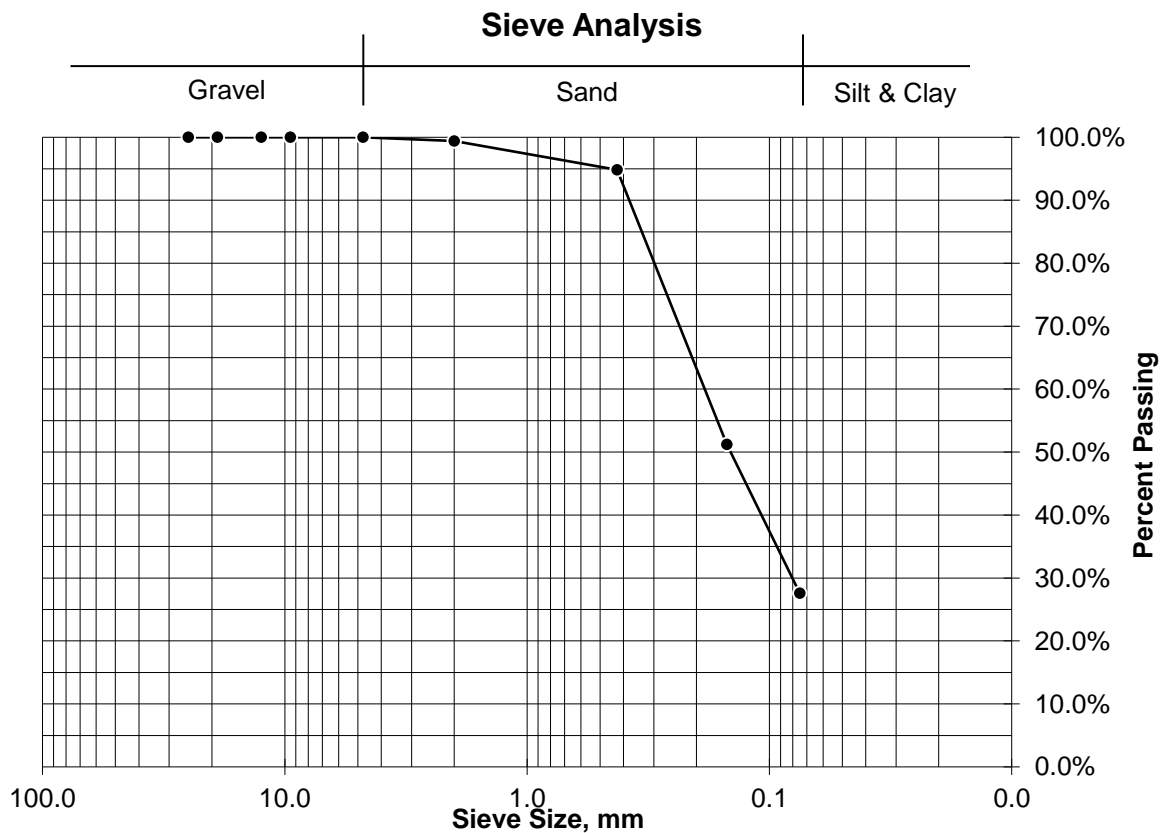


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.45	0.6%	2.00	99.4%
No. 40	3.48	4.6%	0.425	94.8%
No. 100	33.13	43.6%	0.15	51.2%
No. 200	17.95	23.6%	0.075	27.6%
Pan	0.92	1.2%		
Total	55.93	73.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-08

Sample Depth 20'-22'

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Visual Sample Description Micaceous Brownish-Gray Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	20
Pan Wt	189.94 grams
Pan + Soil (wet)	298.08 grams
Pan + Soil (dry)	274.42 grams
Natural Moisture Content	28.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 255.08 grams

Percent Passing No. 200 Sieve 22.9%

Pan + Soil retained on No. 4 sieve

(dry) 190.42 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-08

Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

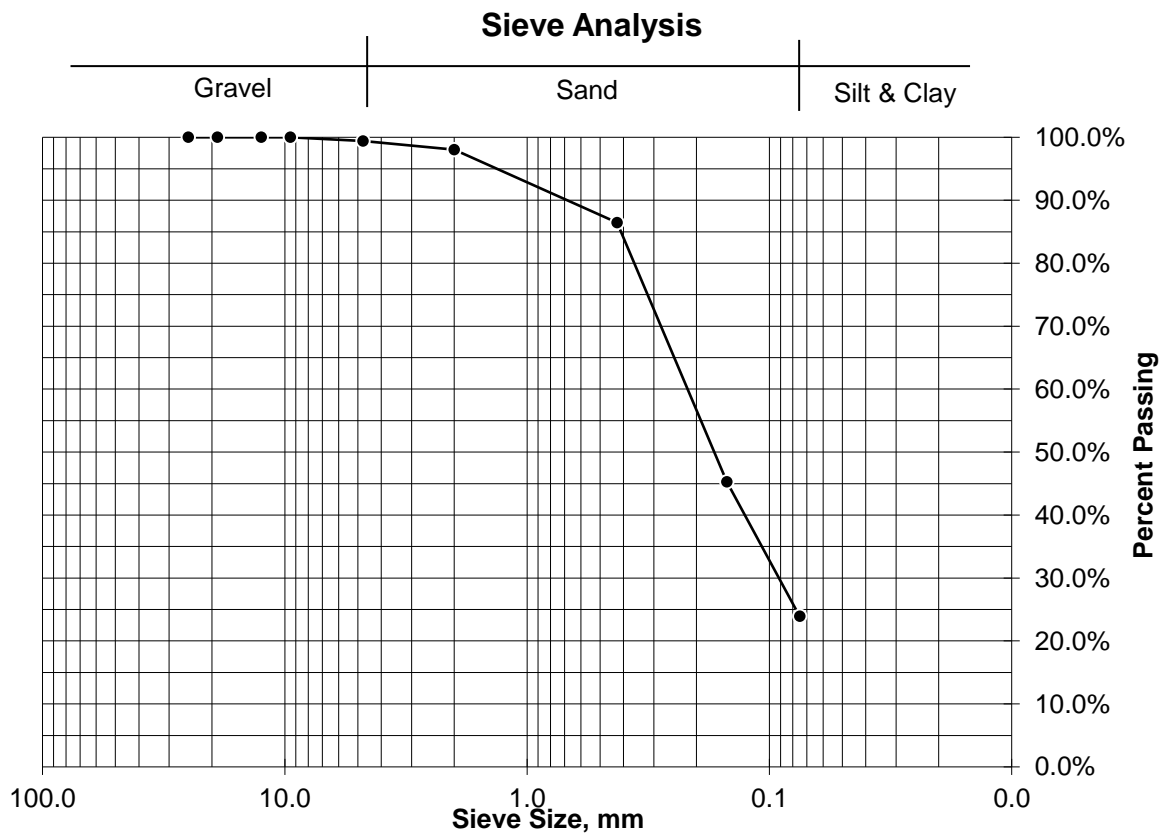


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.48	0.6%	4.75	99.4%
No. 10	1.16	1.4%	2.00	98.1%
No. 40	9.80	11.6%	0.425	86.5%
No. 100	34.77	41.2%	0.15	45.3%
No. 200	18.07	21.4%	0.075	23.9%
Pan	0.83	1.0%		
Total	65.11	77.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-09

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	38
Pan Wt	193.63 grams
Pan + Soil (wet)	296.08 grams
Pan + Soil (dry)	271.63 grams
Natural Moisture Content	31.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 238.65 grams

Percent Passing No. 200 Sieve 42.3%

Pan + Soil retained on No. 4 sieve

(dry) 193.63 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/2/2019

Liquid Limit

No of Blows	17	23	34
Pan ID	6	9	62
Pan Wt	11.18	11.14	10.87
Pan + Soil (wet)	20.78	31.60	21.61
Pan + Soil (dry)	17.11	24.10	17.87
Moisture Content	61.8%	57.9%	53.4%
Liquid Limit	59	57	55
Liquid Limit	57		

Plastic Limit

Pan ID	79	317
Pan Weight	4.24	8.09
Pan + Soil (wet)	14.44	18.73
Pan + Soil (dry)	11.31	15.46
Moisture Content	44.3%	44.4%
Plastic Limit	44	
Plastic Index	13	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

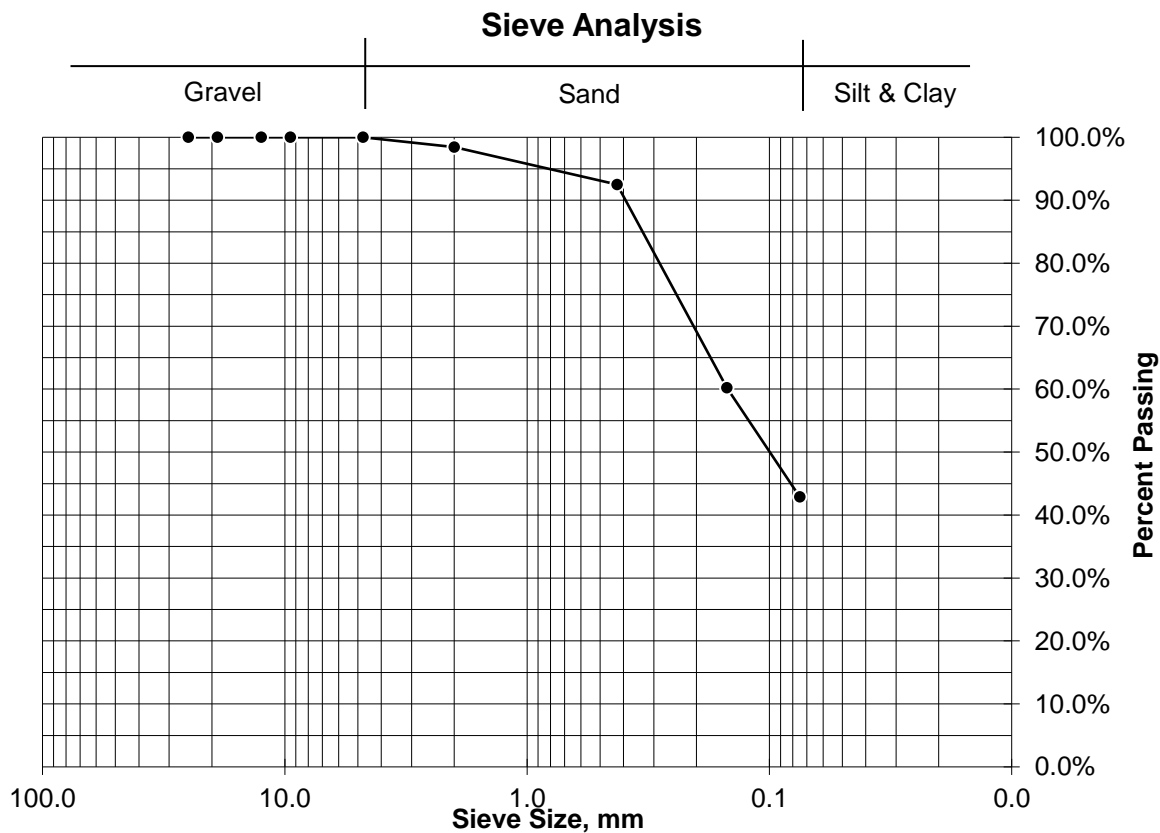
Prepared By: CBW

Sample ID DAA-09

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.21	1.6%	2.00	98.4%
No. 40	4.63	5.9%	0.425	92.5%
No. 100	25.17	32.3%	0.15	60.2%
No. 200	13.53	17.3%	0.075	42.9%
Pan	0.48	0.6%		
Total	45.02	57.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-09

Sample Depth 20'-22'

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Visual Sample Description Micaceous Brownish-Gray Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	31
Pan Wt	193.03 grams
Pan + Soil (wet)	308.43 grams
Pan + Soil (dry)	295.67 grams
Natural Moisture Content	12.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 278.85 grams

Percent Passing No. 200 Sieve 16.4%

Pan + Soil retained on No. 4 sieve

(dry) 193.49 grams

Percent Passing No. 4 Sieve 99.6%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-09

Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

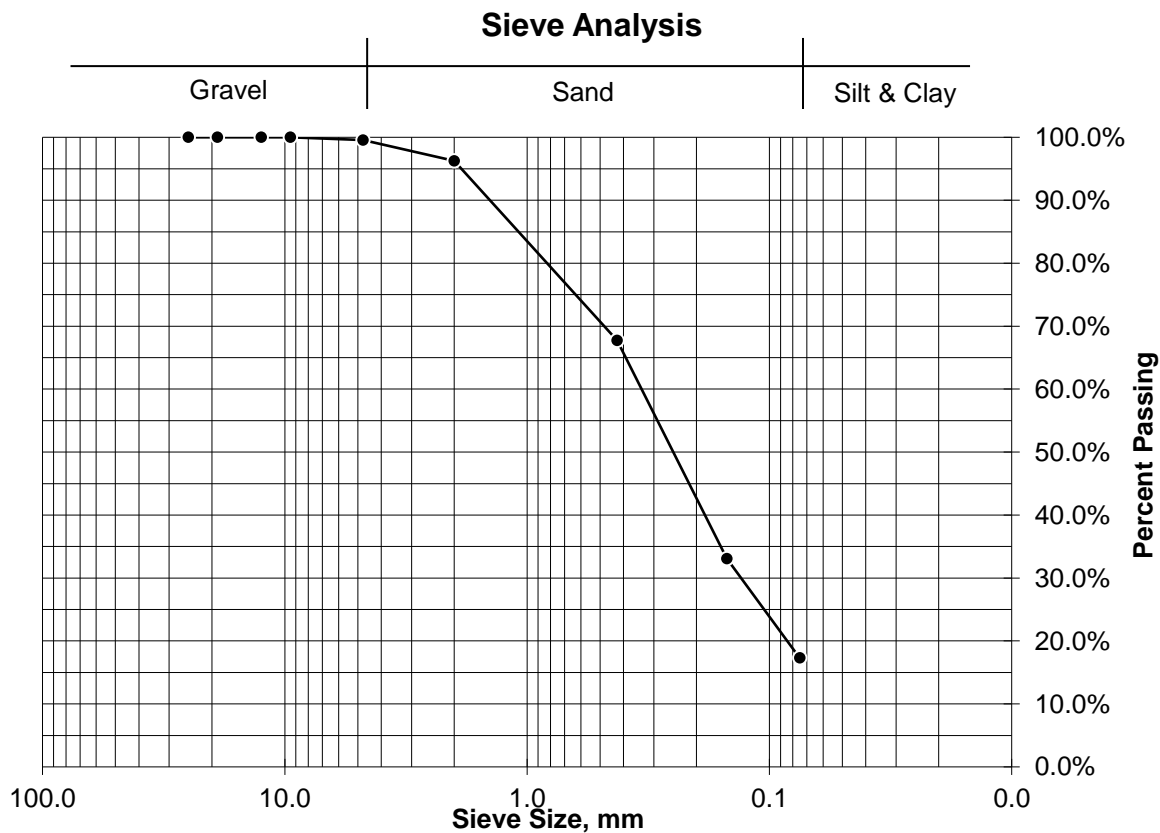


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.46	0.4%	4.75	99.6%
No. 10	3.36	3.3%	2.00	96.3%
No. 40	29.30	28.5%	0.425	67.7%
No. 100	35.57	34.7%	0.15	33.1%
No. 200	16.19	15.8%	0.075	17.3%
Pan	0.93	0.9%		
Total	85.81	83.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-10

Sample Depth 22'-24'

Visual Sample Description Brownish Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	101
Pan Wt	122.79 grams
Pan + Soil (wet)	236.05 grams
Pan + Soil (dry)	224.08 grams
Natural Moisture Content	11.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 206.06 grams

Percent Passing No. 200 Sieve 17.8%

Pan + Soil retained on No. 4 sieve

(dry) 125.12 grams

Percent Passing No. 4 Sieve 97.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/25/2019

Liquid Limit

No of Blows	18	24	34
Pan ID	2000	92	102
Pan Wt	25.70	25.63	24.01
Pan + Soil (wet)	37.17	36.23	37.46
Pan + Soil (dry)	33.92	33.39	34.14
Moisture Content	39.5%	36.6%	32.8%
Liquid Limit	38	36	34
Liquid Limit	36		

Plastic Limit

Pan ID	315	353
Pan Weight	9.14	9.12
Pan + Soil (wet)	22.89	22.11
Pan + Soil (dry)	19.88	19.28
Moisture Content	28.0%	27.9%
Plastic Limit	28	
Plastic Index	8	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-10

Sample Depth 22'-24'

Mechanical Sieve Analysis: ASTM D 422

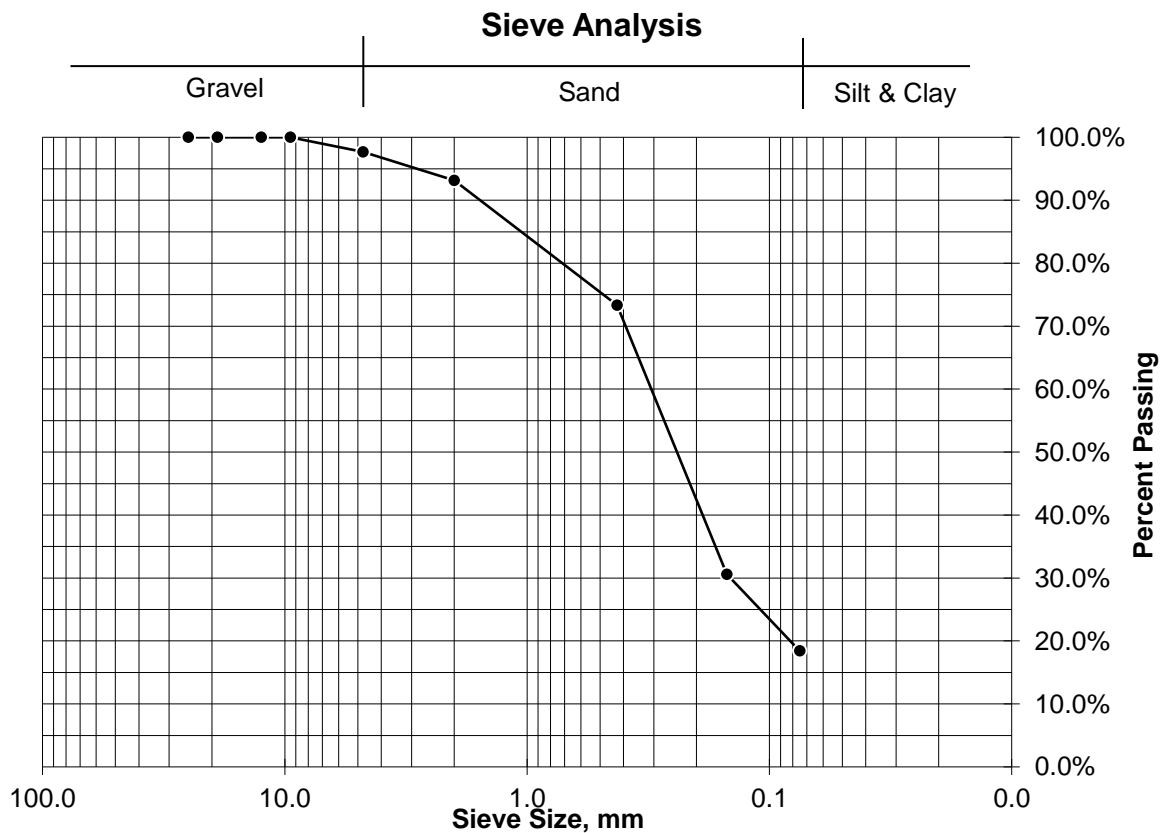


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	2.33	2.3%	4.75	97.7%
No. 10	4.62	4.6%	2.00	93.1%
No. 40	20.05	19.8%	0.425	73.3%
No. 100	43.31	42.8%	0.15	30.6%
No. 200	12.32	12.2%	0.075	18.4%
Pan	0.64	0.6%		
Total	83.27	82.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-10
Sample Depth 24'-26'
Visual Sample Description Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	39
Pan Wt	192.99 grams
Pan + Soil (wet)	305.74 grams
Pan + Soil (dry)	294.04 grams
Natural Moisture Content	11.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve
(dry) 264.20 grams
Percent Passing No. 200 Sieve 29.5%

Pan + Soil retained on No. 4 sieve
(dry) 192.99 grams
Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**
Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-10

Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

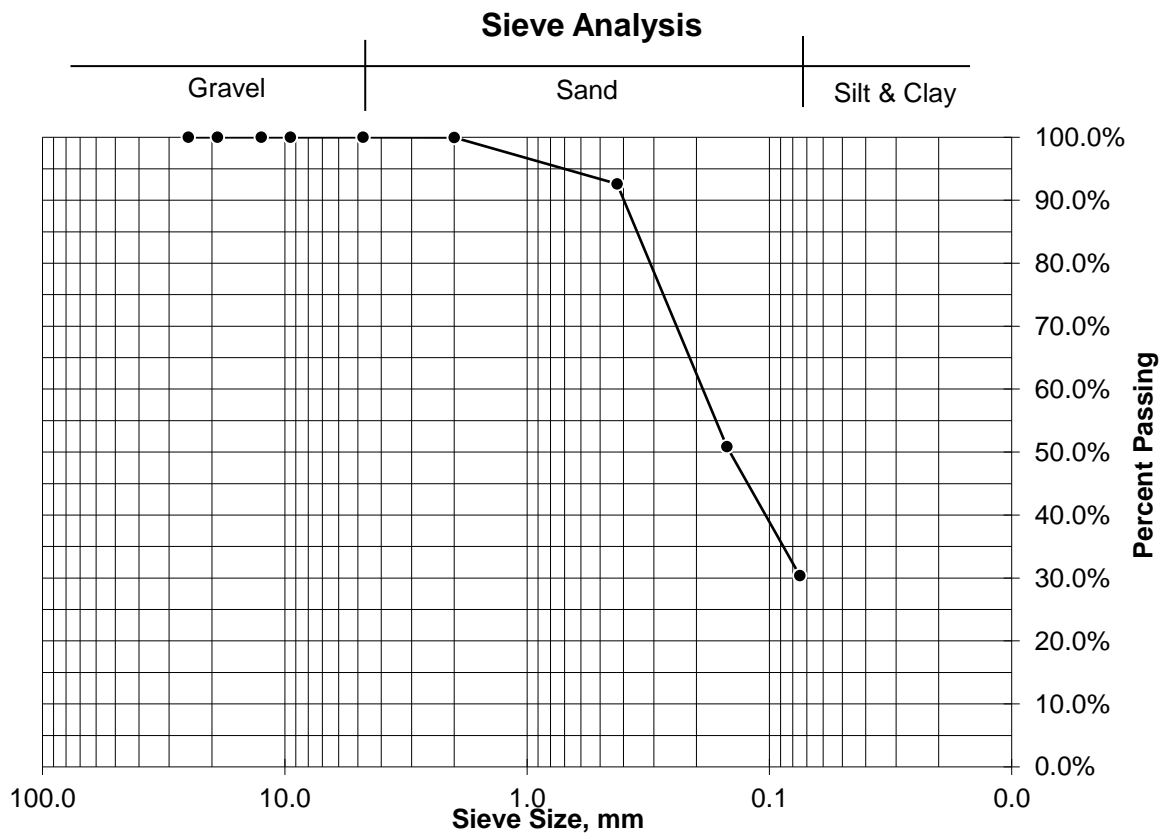


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.03	0.0%	2.00	100.0%
No. 40	7.45	7.4%	0.425	92.6%
No. 100	42.14	41.7%	0.15	50.9%
No. 200	20.70	20.5%	0.075	30.4%
Pan	0.88	0.9%		
Total	71.20	70.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-12

Sample Depth 25'-27'

Visual Sample Description Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	33
Pan Wt	193.68 grams
Pan + Soil (wet)	312.10 grams
Pan + Soil (dry)	307.83 grams
Natural Moisture Content	3.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 287.06 grams

Percent Passing No. 200 Sieve 18.2%

Pan + Soil retained on No. 4 sieve

(dry) 194.40 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-12

Sample Depth 25'-27'

Mechanical Sieve Analysis: ASTM D 422

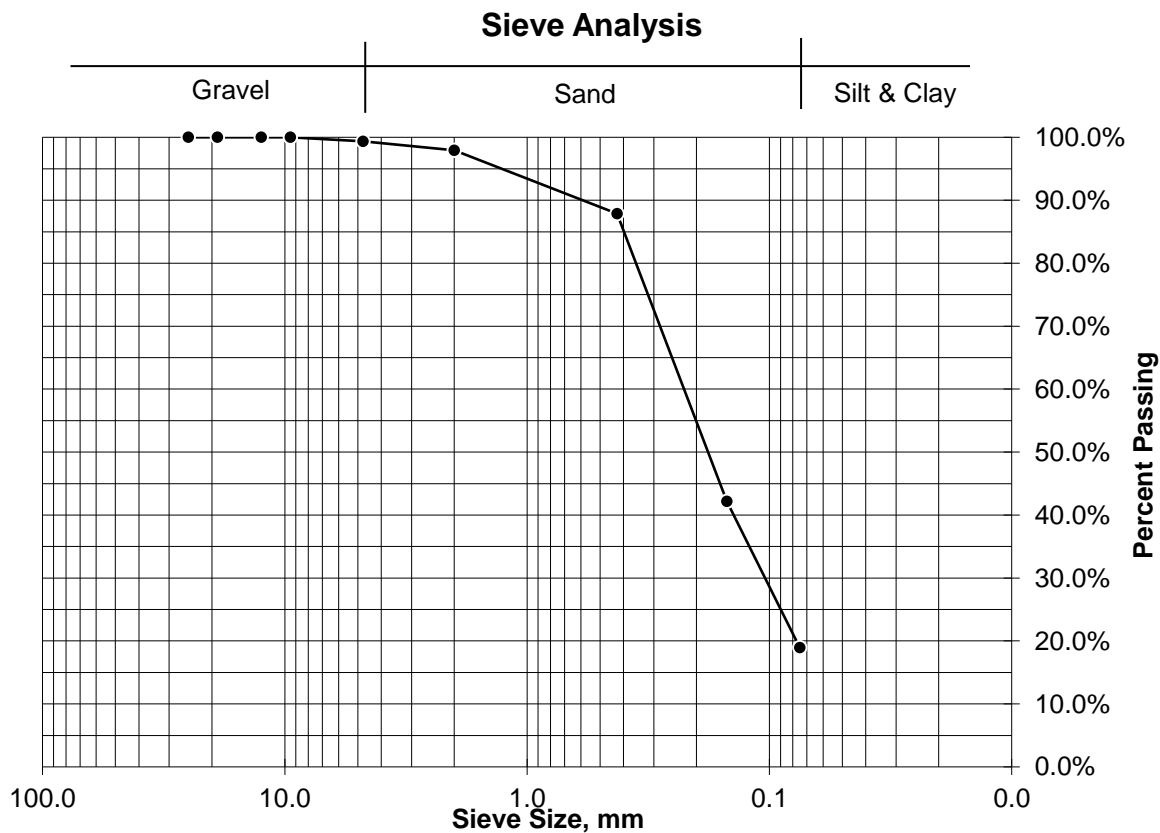


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.72	0.6%	4.75	99.4%
No. 10	1.65	1.4%	2.00	97.9%
No. 40	11.45	10.0%	0.425	87.9%
No. 100	52.16	45.7%	0.15	42.2%
No. 200	26.51	23.2%	0.075	19.0%
Pan	0.87	0.8%		
Total	93.36	81.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-13

Sample Depth 8'-10'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	22
Pan Wt	189.00 grams
Pan + Soil (wet)	296.08 grams
Pan + Soil (dry)	277.42 grams
Natural Moisture Content	21.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 250.40 grams

Percent Passing No. 200 Sieve 30.6%

Pan + Soil retained on No. 4 sieve

(dry) 189.00 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows	18	24	35
Pan ID	94	108	109
Pan Wt	23.81	33.16	25.00
Pan + Soil (wet)	42.00	51.14	42.51
Pan + Soil (dry)	36.56	46.05	37.92
Moisture Content	42.7%	39.5%	35.5%
Liquid Limit	41	39	37
Liquid Limit	39		

Plastic Limit

Pan ID	313	316
Pan Weight	9.17	9.09
Pan + Soil (wet)	22.43	22.78
Pan + Soil (dry)	19.42	19.68
Moisture Content	29.4%	29.3%
Plastic Limit	29	
Plastic Index	10	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-13

Sample Depth 8'-10'

Mechanical Sieve Analysis: ASTM D 422

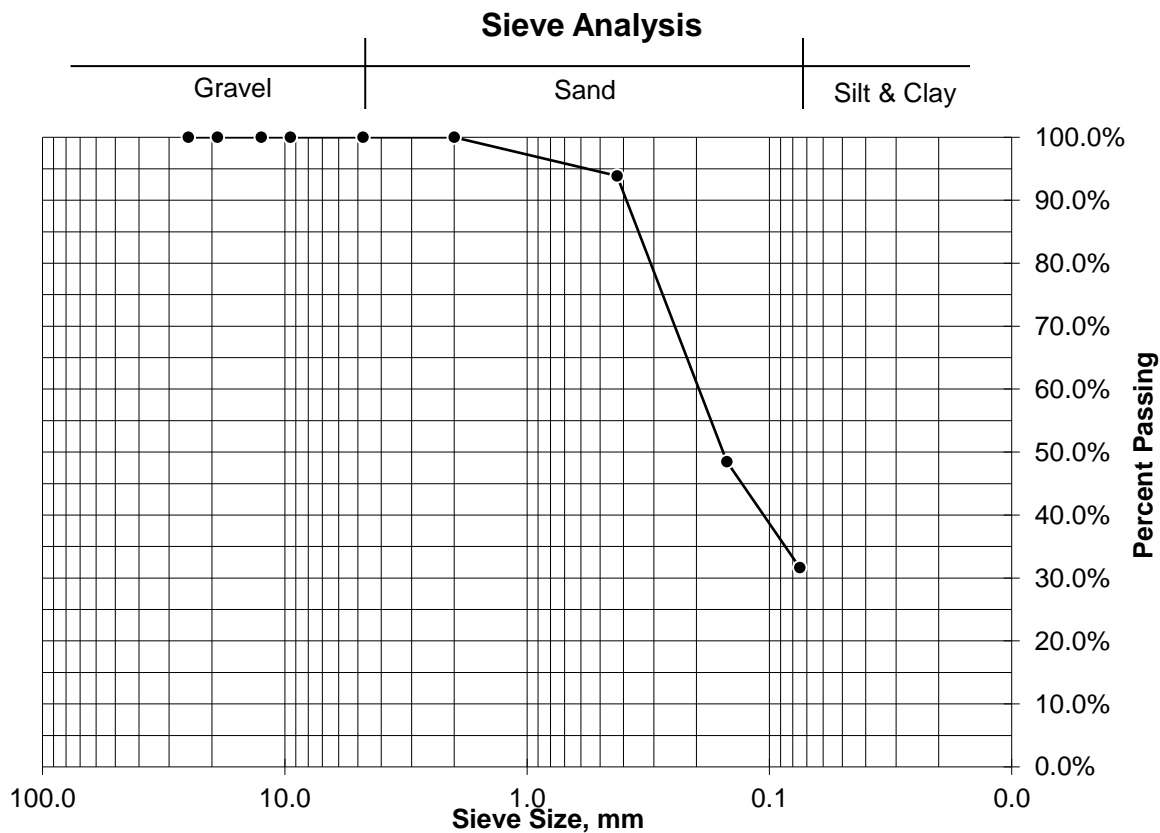


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	5.40	6.1%	0.425	93.9%
No. 100	40.17	45.4%	0.15	48.5%
No. 200	14.84	16.8%	0.075	31.7%
Pan	0.98	1.1%		
Total	61.39	69.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-13

Sample Depth 14'-16'

Visual Sample Description Micaceous Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	36
Pan Wt	193.75 grams
Pan + Soil (wet)	296.27 grams
Pan + Soil (dry)	284.81 grams
Natural Moisture Content	12.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 261.66 grams

Percent Passing No. 200 Sieve 25.4%

Pan + Soil retained on No. 4 sieve

(dry) 194.29 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows	16	25	32
Pan ID	101	105	107
Pan Wt	24.02	29.28	25.11
Pan + Soil (wet)	41.09	50.43	44.11
Pan + Soil (dry)	36.36	45.01	39.58
Moisture Content	38.3%	34.5%	31.3%
Liquid Limit	36	34	32
Liquid Limit	34		

Plastic Limit

Pan ID	2	4
Pan Weight	9.03	9.02
Pan + Soil (wet)	26.00	24.05
Pan + Soil (dry)	22.37	20.83
Moisture Content	27.2%	27.3%
Plastic Limit	27	
Plastic Index	7	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-13

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

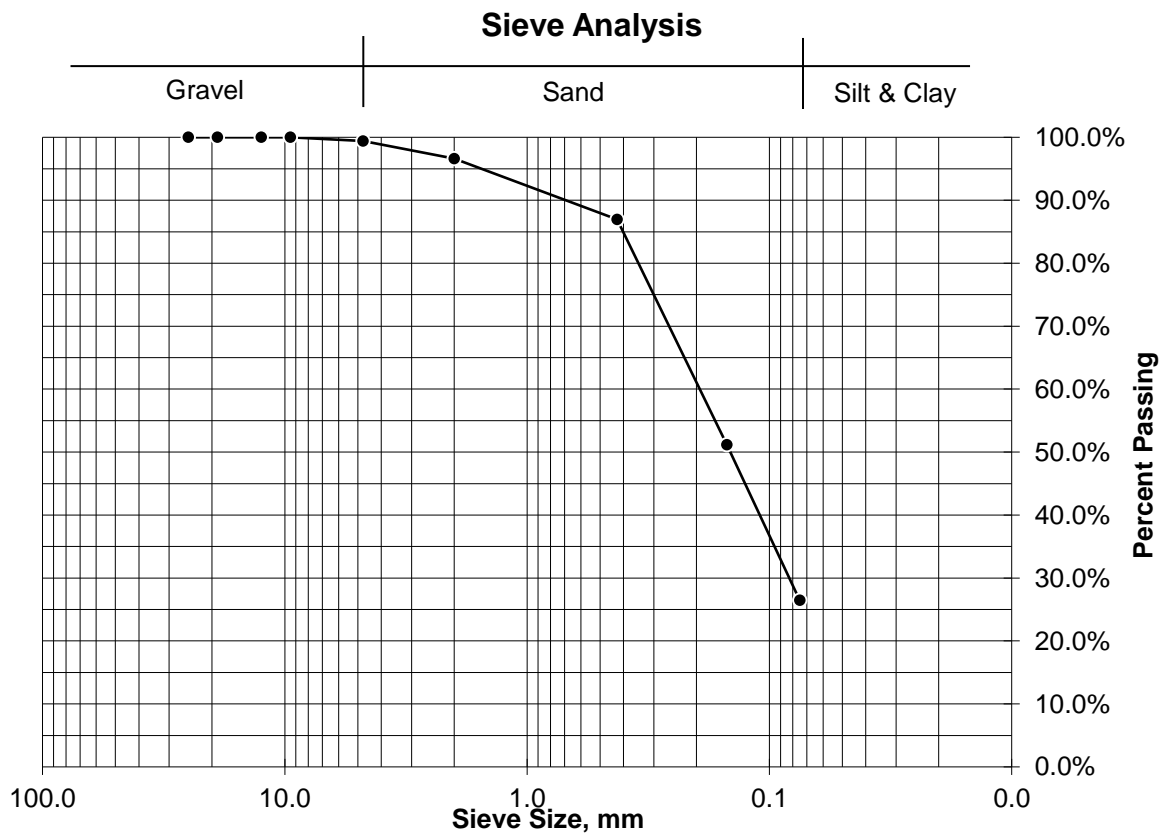


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.54	0.6%	4.75	99.4%
No. 10	2.55	2.8%	2.00	96.6%
No. 40	8.77	9.6%	0.425	87.0%
No. 100	32.59	35.8%	0.15	51.2%
No. 200	22.50	24.7%	0.075	26.5%
Pan	0.95	1.0%		
Total	67.90	74.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-13

Sample Depth 26'-28'

Visual Sample Description Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	42
Pan Wt	192.26 grams
Pan + Soil (wet)	295.02 grams
Pan + Soil (dry)	279.80 grams
Natural Moisture Content	17.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 264.47 grams

Percent Passing No. 200 Sieve 17.5%

Pan + Soil retained on No. 4 sieve

(dry) 192.26 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-13

Sample Depth 26'-28'

Mechanical Sieve Analysis: ASTM D 422

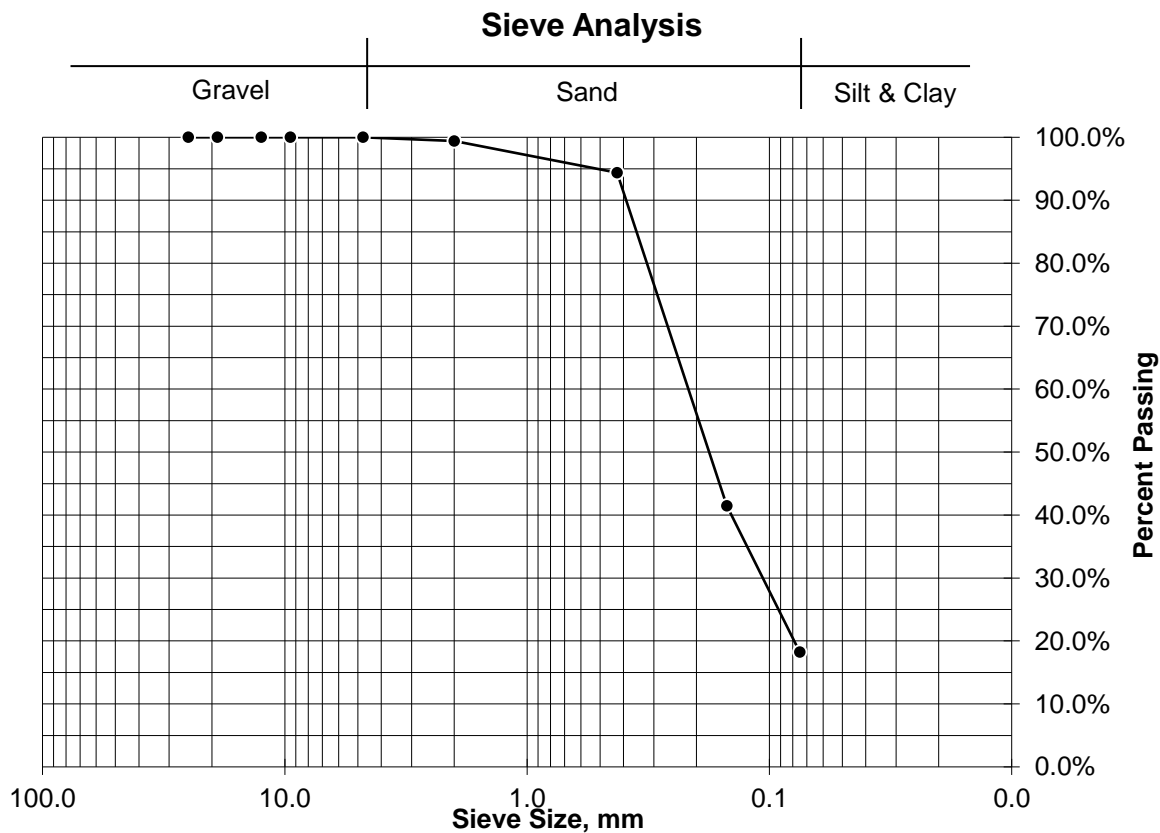


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.50	0.6%	2.00	99.4%
No. 40	4.43	5.1%	0.425	94.4%
No. 100	46.33	52.9%	0.15	41.4%
No. 200	20.30	23.2%	0.075	18.3%
Pan	0.65	0.7%		
Total	72.21	82.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-13

Sample Depth 28'-30'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	27
Pan Wt	193.73 grams
Pan + Soil (wet)	306.26 grams
Pan + Soil (dry)	291.52 grams
Natural Moisture Content	15.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 260.69 grams

Percent Passing No. 200 Sieve 31.5%

Pan + Soil retained on No. 4 sieve

(dry) 193.73 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/21/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-13

Sample Depth 28'-30'

Mechanical Sieve Analysis: ASTM D 422

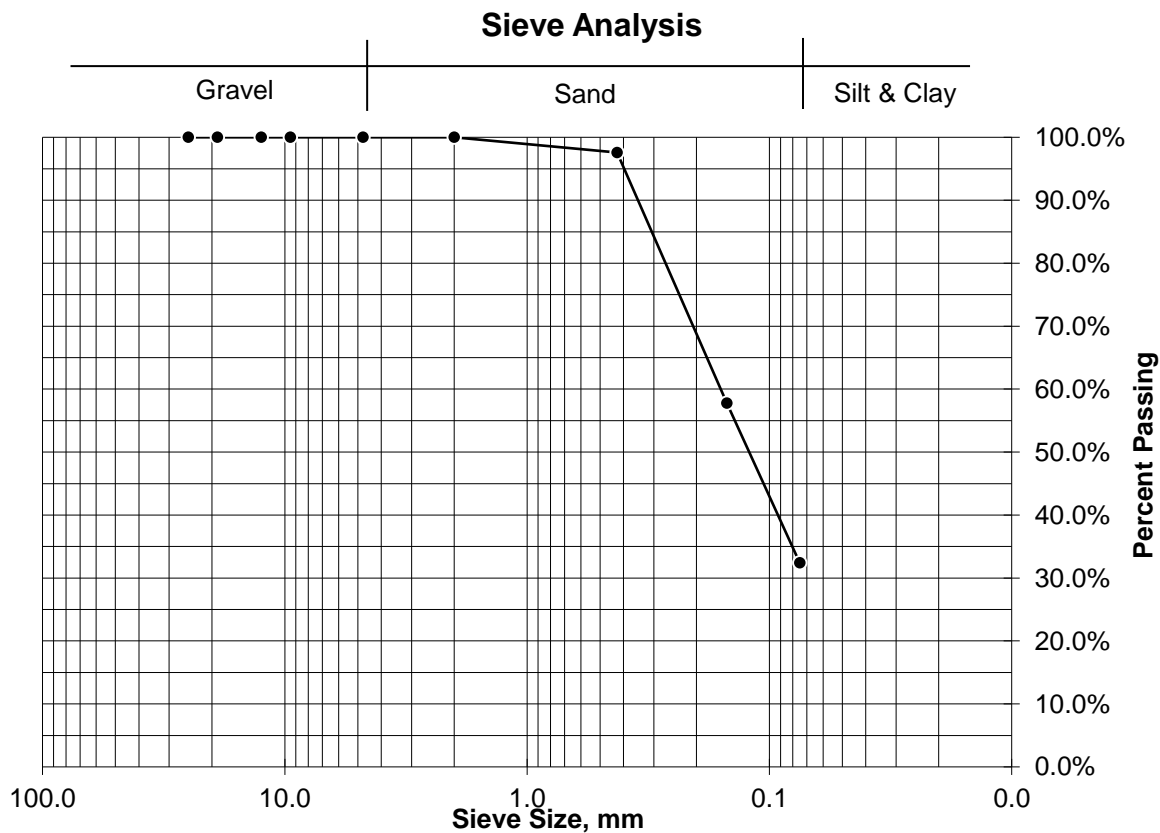


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Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	2.36	2.4%	0.425	97.6%
No. 100	38.90	39.8%	0.15	57.8%
No. 200	24.81	25.4%	0.075	32.4%
Pan	0.86	0.9%		
Total	66.93	68.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-14

Sample Depth 6'-8'

Visual Sample Description Reddish-Brown Sandy Elastic SILT

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	1
Pan Wt	195.48 grams
Pan + Soil (wet)	297.07 grams
Pan + Soil (dry)	273.14 grams
Natural Moisture Content	30.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 230.92 grams

Percent Passing No. 200 Sieve 54.4%

Pan + Soil retained on No. 4 sieve

(dry) 195.48 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/26/2019

Liquid Limit

No of Blows	16	27	33
Pan ID	2000	102	92
Pan Wt	25.73	24.03	25.68
Pan + Soil (wet)	36.84	35.62	36.77
Pan + Soil (dry)	32.18	31.05	32.53
Moisture Content	72.2%	65.1%	61.9%
Liquid Limit	68	66	64
Liquid Limit	66		

Plastic Limit

Pan ID	19	18
Pan Weight	4.36	4.27
Pan + Soil (wet)	15.87	14.96
Pan + Soil (dry)	12.53	11.89
Moisture Content	40.9%	40.3%
Plastic Limit	41	
Plastic Index	25	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-14

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

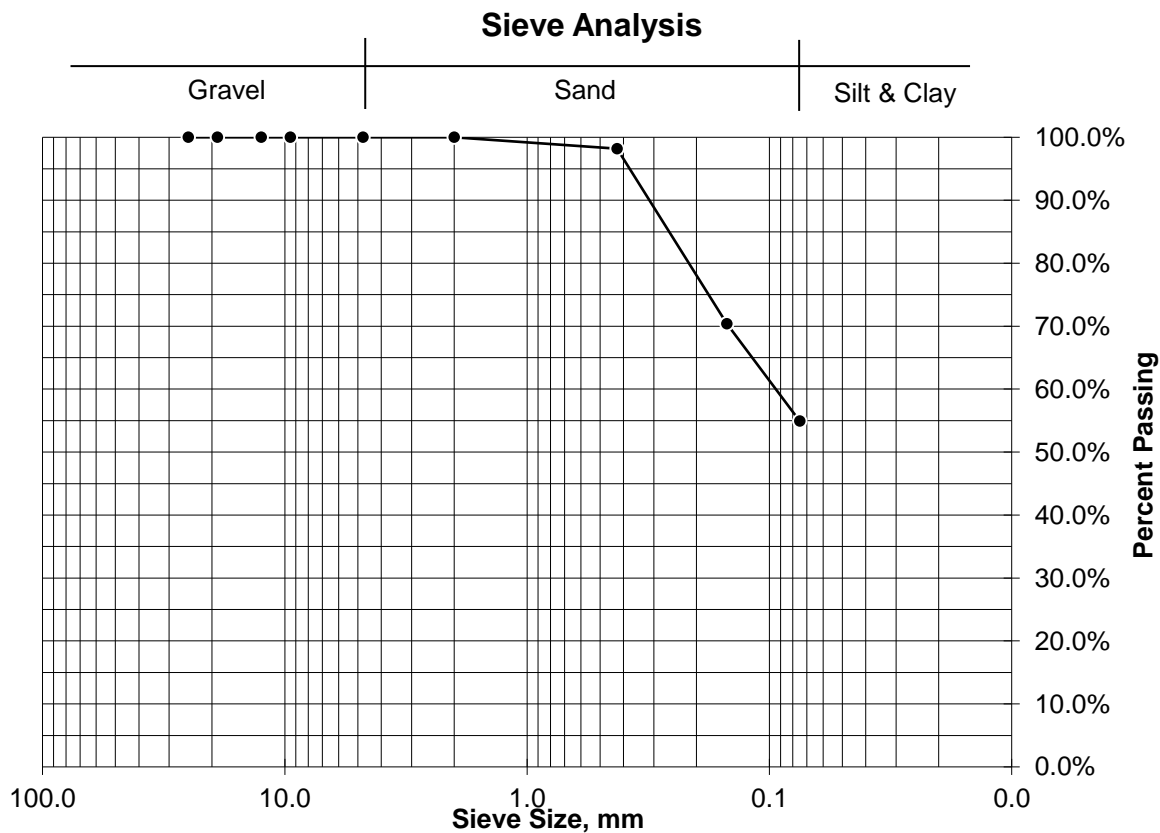


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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	1.40	1.8%	0.425	98.2%
No. 100	21.59	27.8%	0.15	70.4%
No. 200	12.01	15.5%	0.075	54.9%
Pan	0.44	0.6%		
Total	35.44	45.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-14

Sample Depth 10'-12'

Visual Sample Description Reddish-Brown Elastic SILT with Sand

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	33
Pan Wt	193.65 grams
Pan + Soil (wet)	299.18 grams
Pan + Soil (dry)	270.84 grams
Natural Moisture Content	36.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 215.35 grams

Percent Passing No. 200 Sieve 71.9%

Pan + Soil retained on No. 4 sieve

(dry) 193.65 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as *Fine-Grained Soil*

Atterberg Limits: ASTM D 4318

Date Tested: 3/26/2019

Liquid Limit

No of Blows	19	28	33
Pan ID	107	101	105
Pan Wt	25.12	24.01	29.31
Pan + Soil (wet)	35.16	35.82	40.30
Pan + Soil (dry)	30.82	30.92	35.88
Moisture Content	76.1%	70.9%	67.2%
Liquid Limit	74	72	70
Liquid Limit	72		

Plastic Limit

Pan ID	76	79
Pan Weight	4.21	4.24
Pan + Soil (wet)	14.55	15.55
Pan + Soil (dry)	11.80	12.47
Moisture Content	36.2%	37.4%
Plastic Limit	37	
Plastic Index	35	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT with Sand**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-14

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

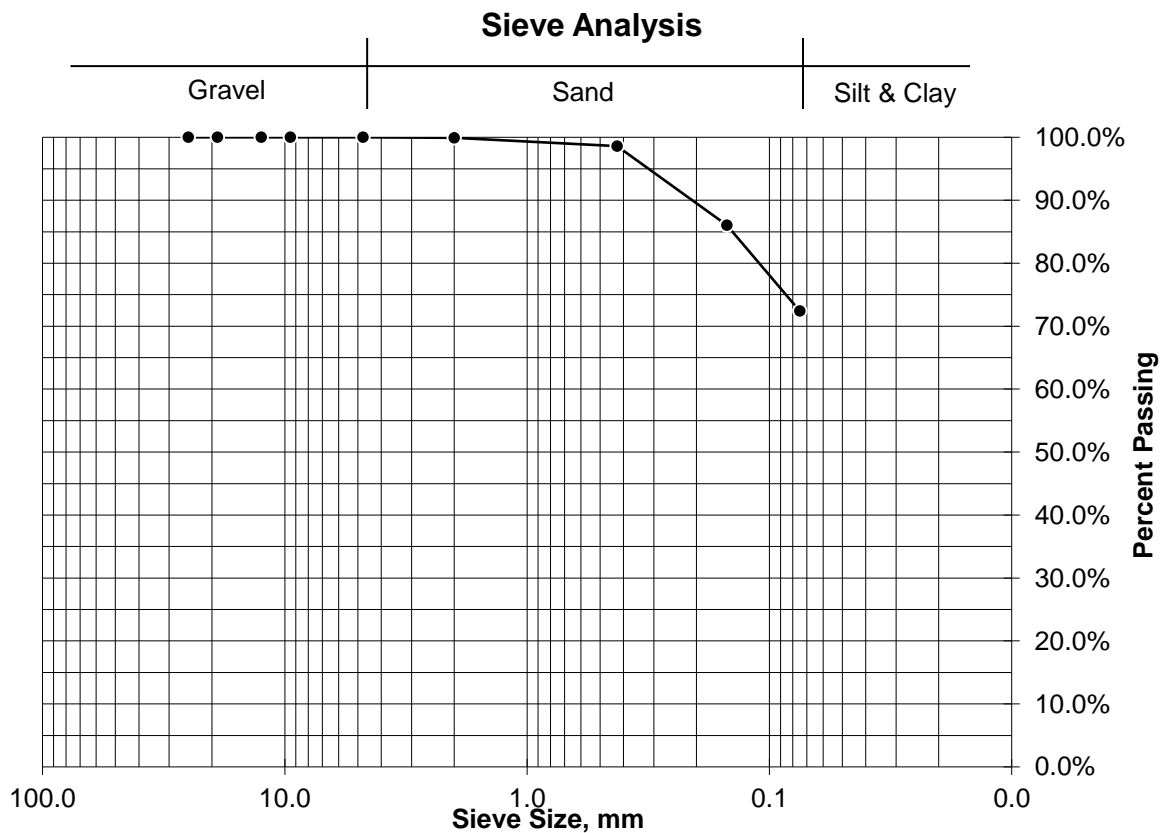


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.08	0.1%	2.00	99.9%
No. 40	1.01	1.3%	0.425	98.6%
No. 100	9.67	12.5%	0.15	86.1%
No. 200	10.52	13.6%	0.075	72.4%
Pan	0.42	0.5%		
Total	21.70	28.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Army Corps of Engineers Certified Laboratory

Sample ID DAA-14

Sample Depth 14'-16'

Visual Sample Description Reddish-Brown Sandy Elastic SILT

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	15
Pan Wt	188.25 grams
Pan + Soil (wet)	288.54 grams
Pan + Soil (dry)	263.15 grams
Natural Moisture Content	33.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 224.55 grams

Percent Passing No. 200 Sieve 51.5%

Pan + Soil retained on No. 4 sieve

(dry) 189.26 grams

Percent Passing No. 4 Sieve 98.7%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/26/2019

Liquid Limit

No of Blows	15	27	33
Pan ID	91	98	93
Pan Wt	24.52	30.34	30.11
Pan + Soil (wet)	36.76	43.64	46.23
Pan + Soil (dry)	31.62	38.37	40.07
Moisture Content	72.3%	65.6%	61.9%
Liquid Limit	68	66	64
Liquid Limit	66		

Plastic Limit

Pan ID	316	2
Pan Weight	9.08	9.03
Pan + Soil (wet)	19.78	19.28
Pan + Soil (dry)	16.62	16.21
Moisture Content	41.9%	42.8%
Plastic Limit	42	
Plastic Index	24	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-14

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

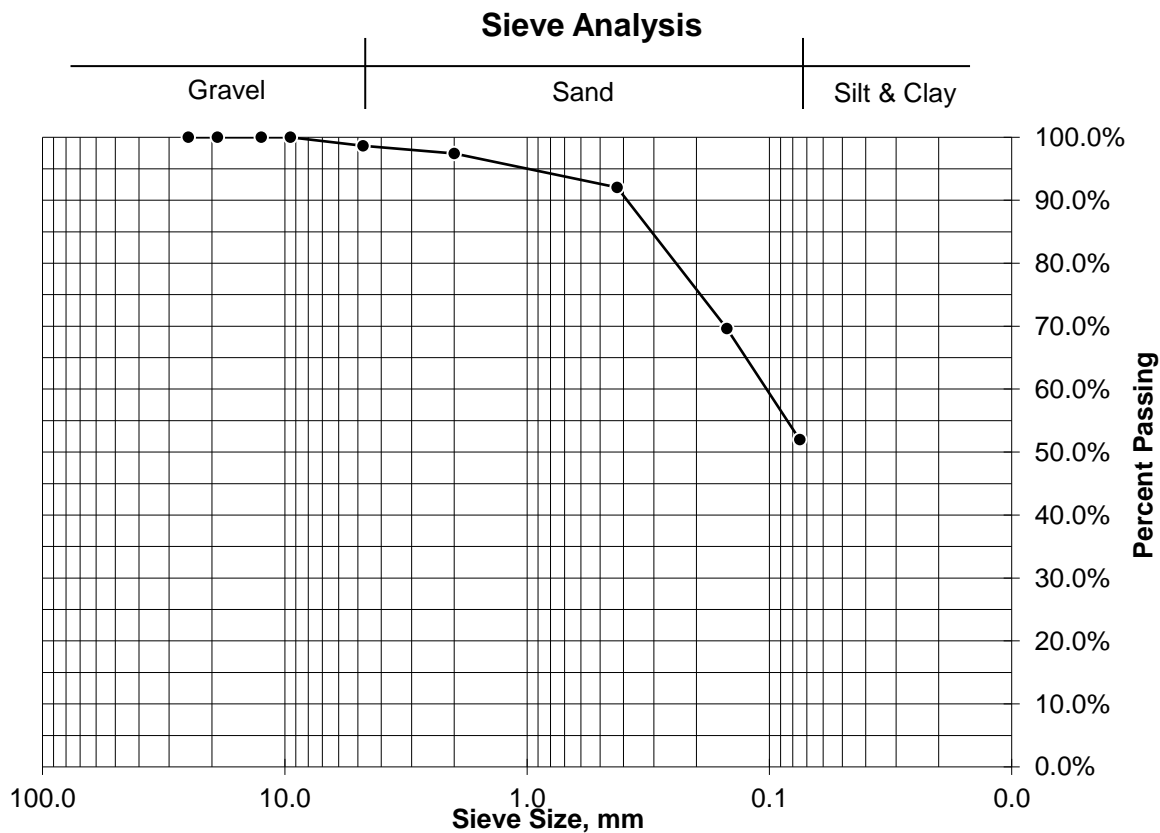


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	1.01	1.3%	4.75	98.7%
No. 10	0.90	1.2%	2.00	97.4%
No. 40	4.07	5.4%	0.425	92.0%
No. 100	16.76	22.4%	0.15	69.6%
No. 200	13.22	17.7%	0.075	52.0%
Pan	0.31	0.4%		
Total	36.27	48.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-14

Sample Depth 24'-26'

Visual Sample Description Reddish-Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/19/2019

Natural Moisture Content: ASTM D 2216

Pan ID	27
Pan Wt	193.72 grams
Pan + Soil (wet)	300.75 grams
Pan + Soil (dry)	271.07 grams
Natural Moisture Content	38.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 233.89 grams

Percent Passing No. 200 Sieve 48.1%

Pan + Soil retained on No. 4 sieve

(dry) 193.88 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/25/2019

Liquid Limit

No of Blows	18	27	33
Pan ID	103	104	97
Pan Wt	27.43	26.24	26.09
Pan + Soil (wet)	37.76	36.38	36.36
Pan + Soil (dry)	33.93	32.79	32.88
Moisture Content	58.9%	54.8%	51.2%
Liquid Limit	57	55	53
Liquid Limit	55		

Plastic Limit

Pan ID	83	4
Pan Weight	4.23	9.02
Pan + Soil (wet)	14.83	19.32
Pan + Soil (dry)	11.81	16.39
Moisture Content	39.8%	39.8%
Plastic Limit	40	
Plastic Index	15	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-14

Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

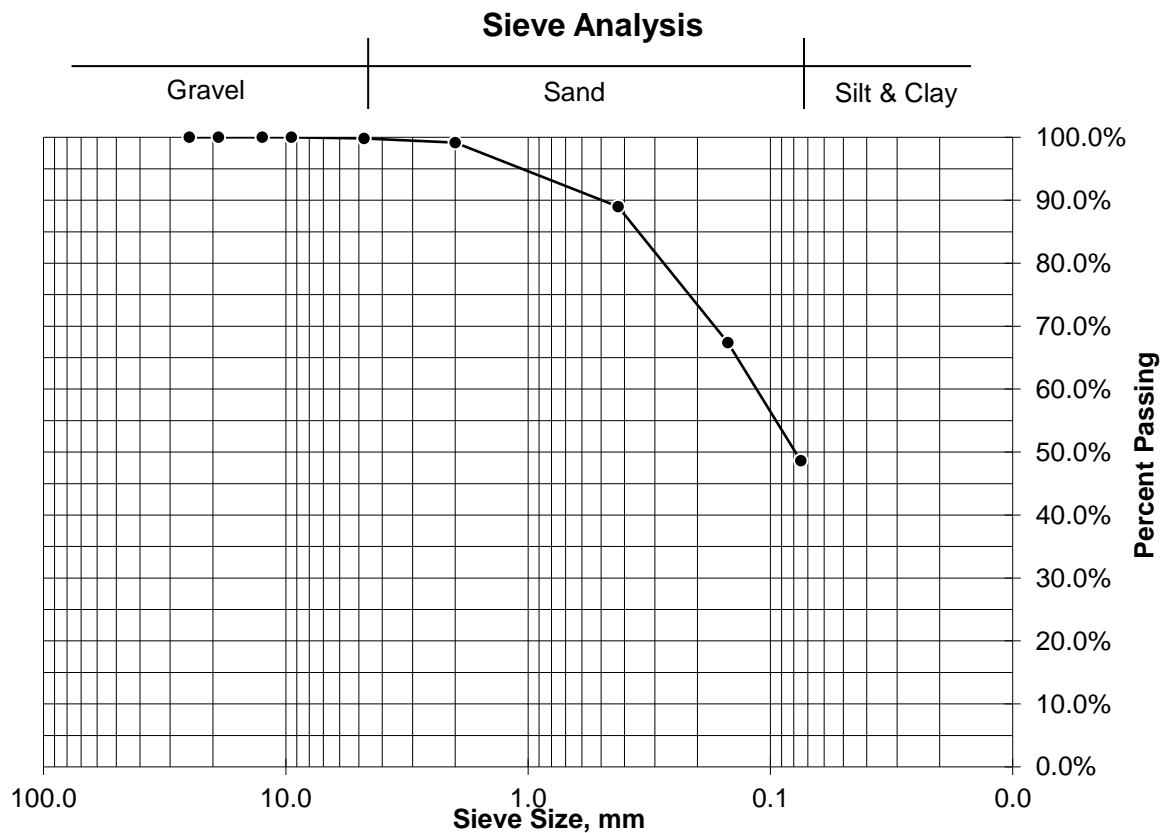


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.16	0.2%	4.75	99.8%
No. 10	0.50	0.6%	2.00	99.1%
No. 40	7.87	10.2%	0.425	89.0%
No. 100	16.71	21.6%	0.15	67.4%
No. 200	14.49	18.7%	0.075	48.6%
Pan	0.44	0.6%		
Total	40.17	51.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-14

Sample Depth 26'-28'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	8
Pan Wt	187.14 grams
Pan + Soil (wet)	289.88 grams
Pan + Soil (dry)	273.99 grams
Natural Moisture Content	18.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 251.07 grams

Percent Passing No. 200 Sieve 26.4%

Pan + Soil retained on No. 4 sieve

(dry) 189.22 grams

Percent Passing No. 4 Sieve 97.6%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/25/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

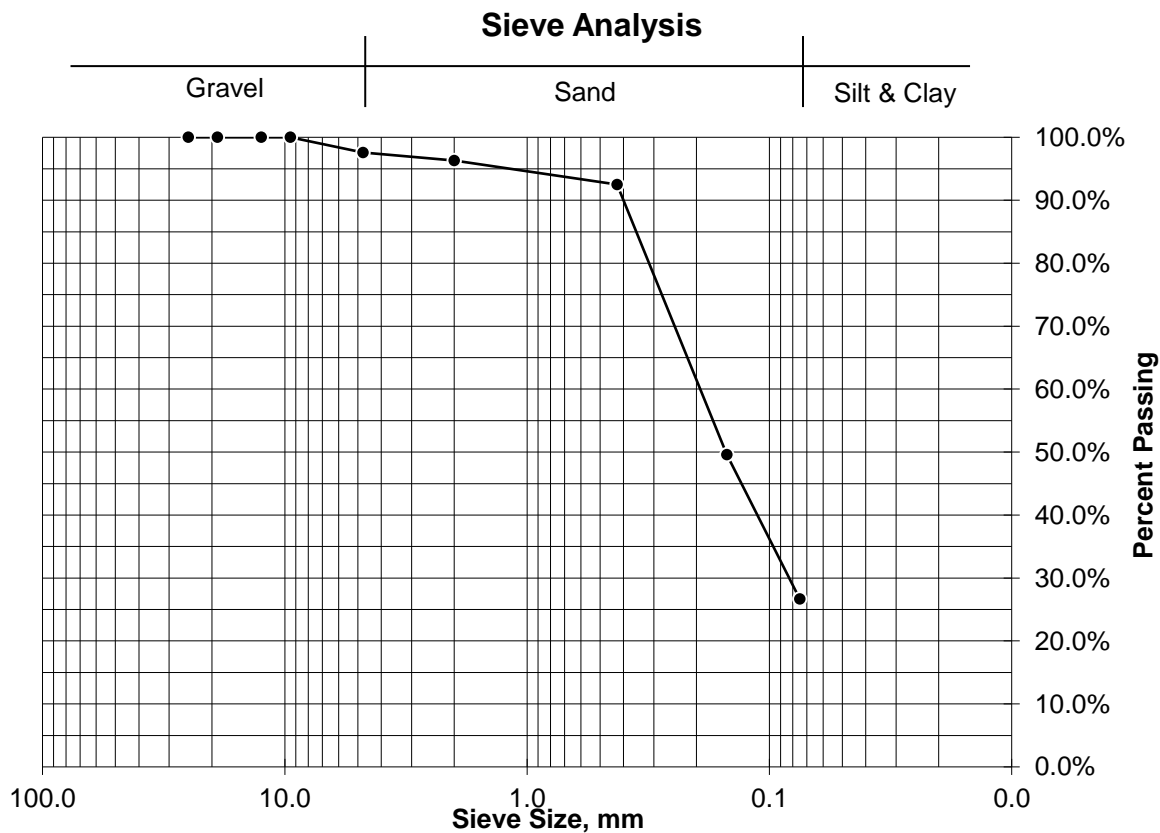
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Sample ID DAA-14

Sample Depth 26'-28'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	2.08	2.4%	4.75	97.6%
No. 10	1.14	1.3%	2.00	96.3%
No. 40	3.30	3.8%	0.425	92.5%
No. 100	37.27	42.9%	0.15	49.6%
No. 200	19.87	22.9%	0.075	26.7%
Pan	0.27	0.3%		
Total	63.93	73.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-14

Sample Depth 30'-32'

Visual Sample Description Light Reddish-Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	17
Pan Wt	188.67 grams
Pan + Soil (wet)	296.57 grams
Pan + Soil (dry)	283.45 grams
Natural Moisture Content	13.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 259.80 grams

Percent Passing No. 200 Sieve 25.0%

Pan + Soil retained on No. 4 sieve

(dry) 195.36 grams

Percent Passing No. 4 Sieve 92.9%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-14

Sample Depth 30'-32'

Mechanical Sieve Analysis: ASTM D 422

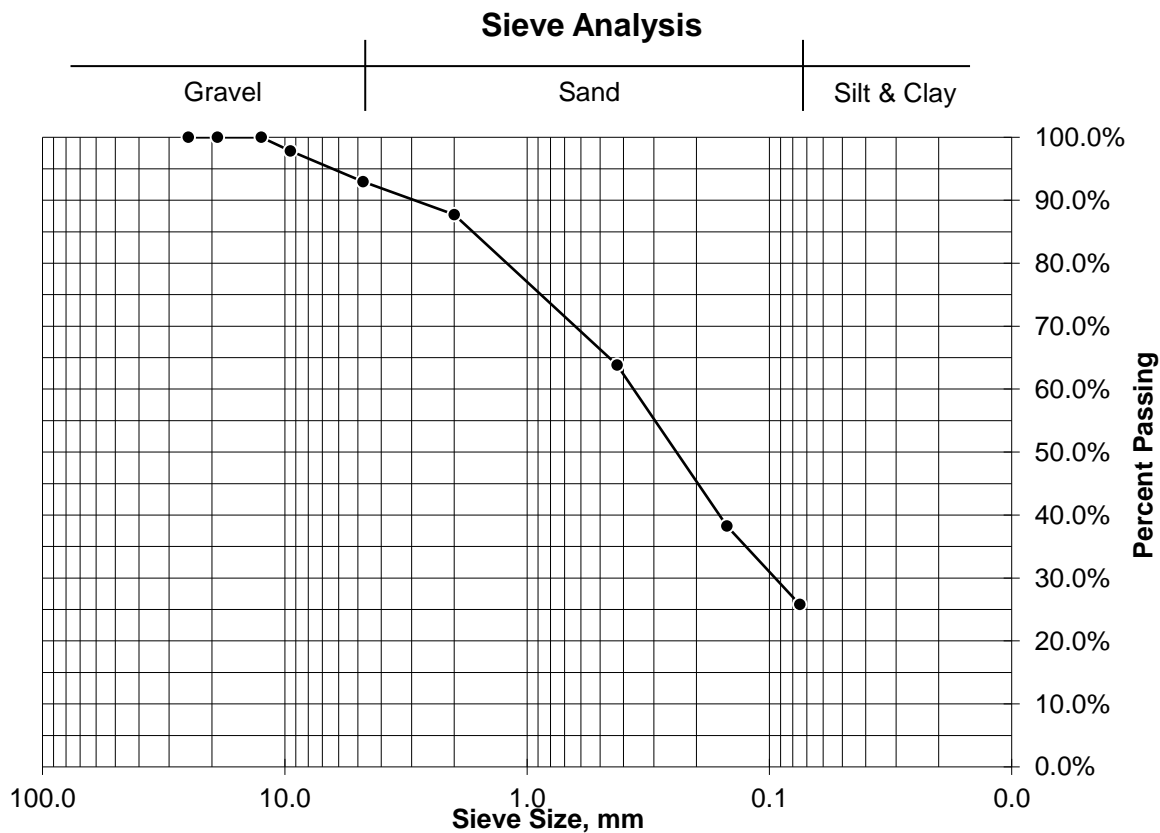


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	2.07	2.2%	9.50	97.8%
No. 4	4.62	4.9%	4.75	92.9%
No. 10	4.96	5.2%	2.00	87.7%
No. 40	22.61	23.9%	0.425	63.9%
No. 100	24.27	25.6%	0.15	38.2%
No. 200	11.80	12.4%	0.075	25.8%
Pan	0.79	0.8%		
Total	71.12	75.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Army Corps of Engineers Certified Laboratory

Sample ID DAA-17

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	4
Pan Wt	194.50 grams
Pan + Soil (wet)	301.33 grams
Pan + Soil (dry)	292.45 grams
Natural Moisture Content	9.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 265.18 grams

Percent Passing No. 200 Sieve 27.8%

Pan + Soil retained on No. 4 sieve

(dry) 194.76 grams

Percent Passing No. 4 Sieve 99.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

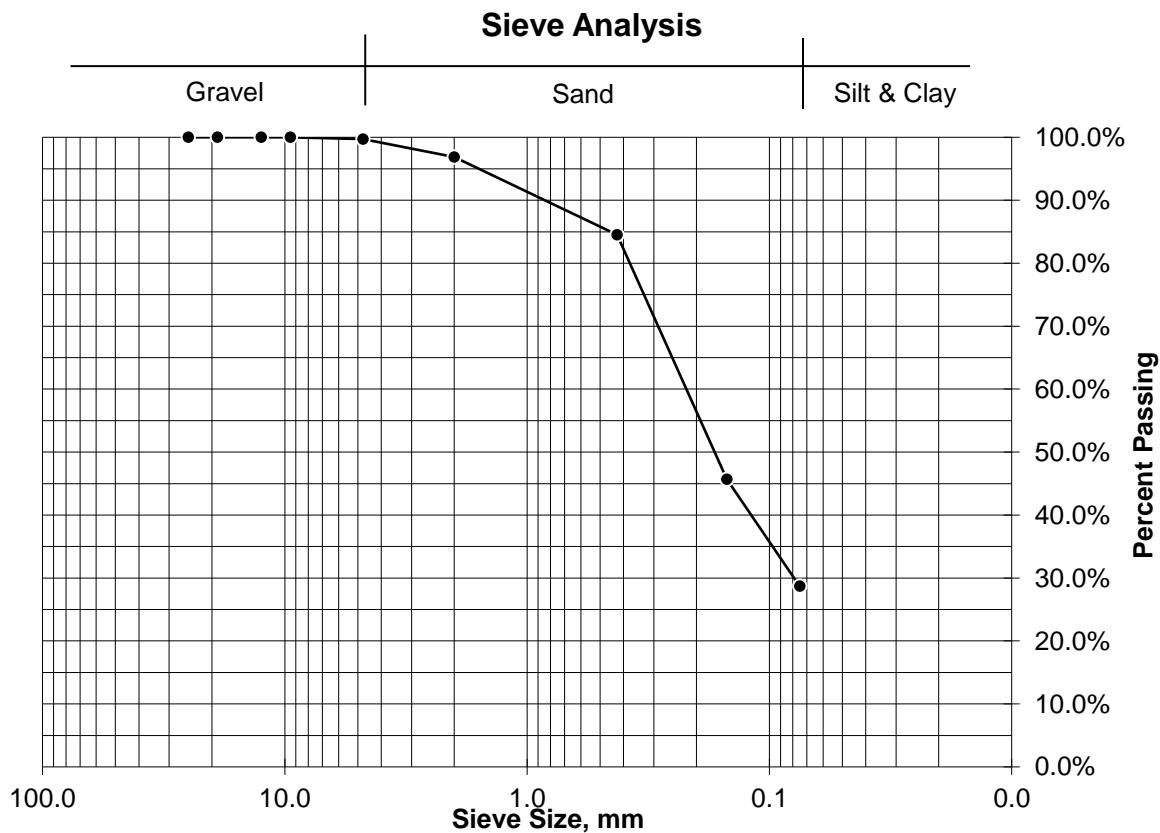
Prepared By: CBW

Sample ID DAA-17

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.26	0.3%	4.75	99.7%
No. 10	2.81	2.9%	2.00	96.9%
No. 40	12.08	12.3%	0.425	84.5%
No. 100	38.03	38.8%	0.15	45.7%
No. 200	16.67	17.0%	0.075	28.7%
Pan	0.82	0.8%		
Total	70.67	72.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-17

Sample Depth 10'-12'

Visual Sample Description Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	30
Pan Wt	193.25 grams
Pan + Soil (wet)	298.76 grams
Pan + Soil (dry)	290.37 grams
Natural Moisture Content	8.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 265.51 grams

Percent Passing No. 200 Sieve 25.6%

Pan + Soil retained on No. 4 sieve

(dry) 195.30 grams

Percent Passing No. 4 Sieve 97.9%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/25/2019

Liquid Limit

No of Blows	18	23	32
Pan ID	169	201	96
Pan Wt	27.16	27.65	24.85
Pan + Soil (wet)	38.29	38.22	35.06
Pan + Soil (dry)	34.85	35.10	32.26
Moisture Content	44.7%	41.9%	37.9%
Liquid Limit	43	41	39
Liquid Limit	41		

Plastic Limit

Pan ID	82	13
Pan Weight	4.23	4.27
Pan + Soil (wet)	14.55	15.29
Pan + Soil (dry)	12.39	12.99
Moisture Content	26.5%	26.4%
Plastic Limit	26	
Plastic Index	14	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

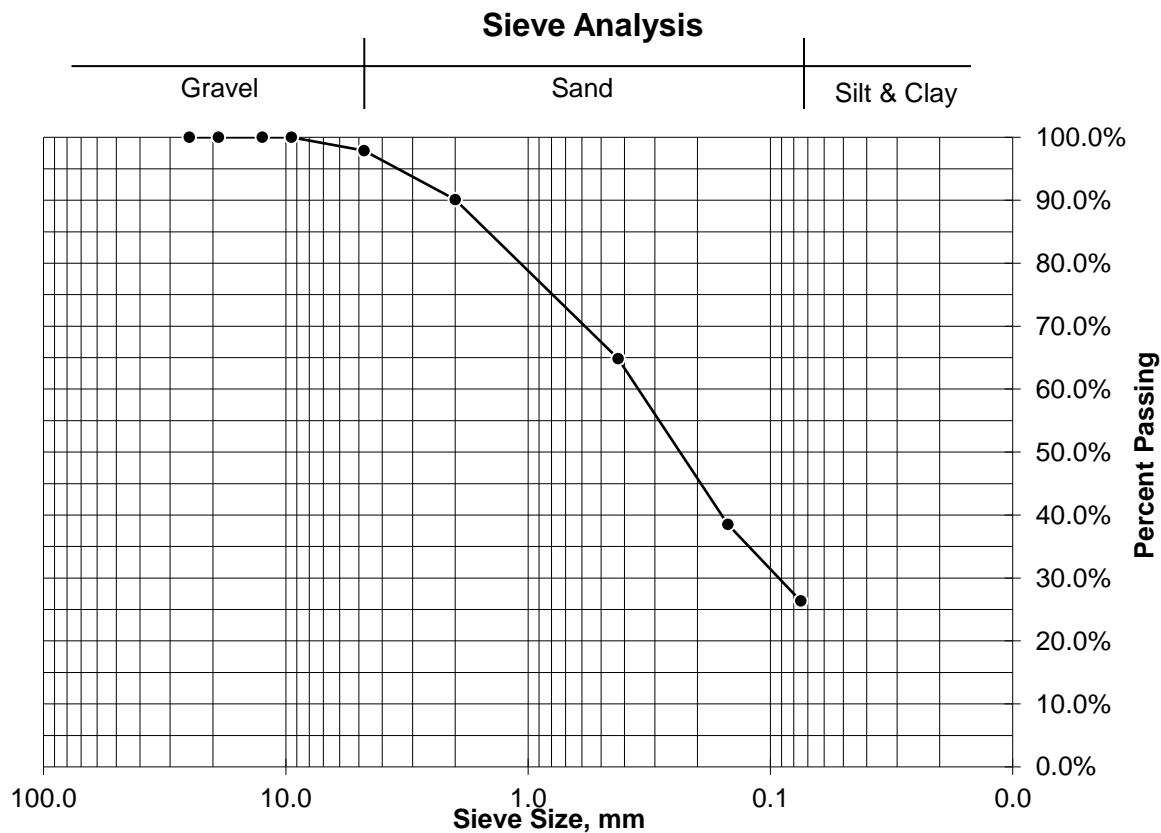
Prepared By: CBW

Sample ID DAA-17

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	2.05	2.1%	4.75	97.9%
No. 10	7.56	7.8%	2.00	90.1%
No. 40	24.55	25.3%	0.425	64.8%
No. 100	25.55	26.3%	0.15	38.5%
No. 200	11.82	12.2%	0.075	26.3%
Pan	0.73	0.8%		
Total	72.26	74.4%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-18

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	34
Pan Wt	192.79 grams
Pan + Soil (wet)	310.43 grams
Pan + Soil (dry)	285.19 grams
Natural Moisture Content	27.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 263.85 grams

Percent Passing No. 200 Sieve 23.1%

Pan + Soil retained on No. 4 sieve

(dry) 194.87 grams

Percent Passing No. 4 Sieve 97.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

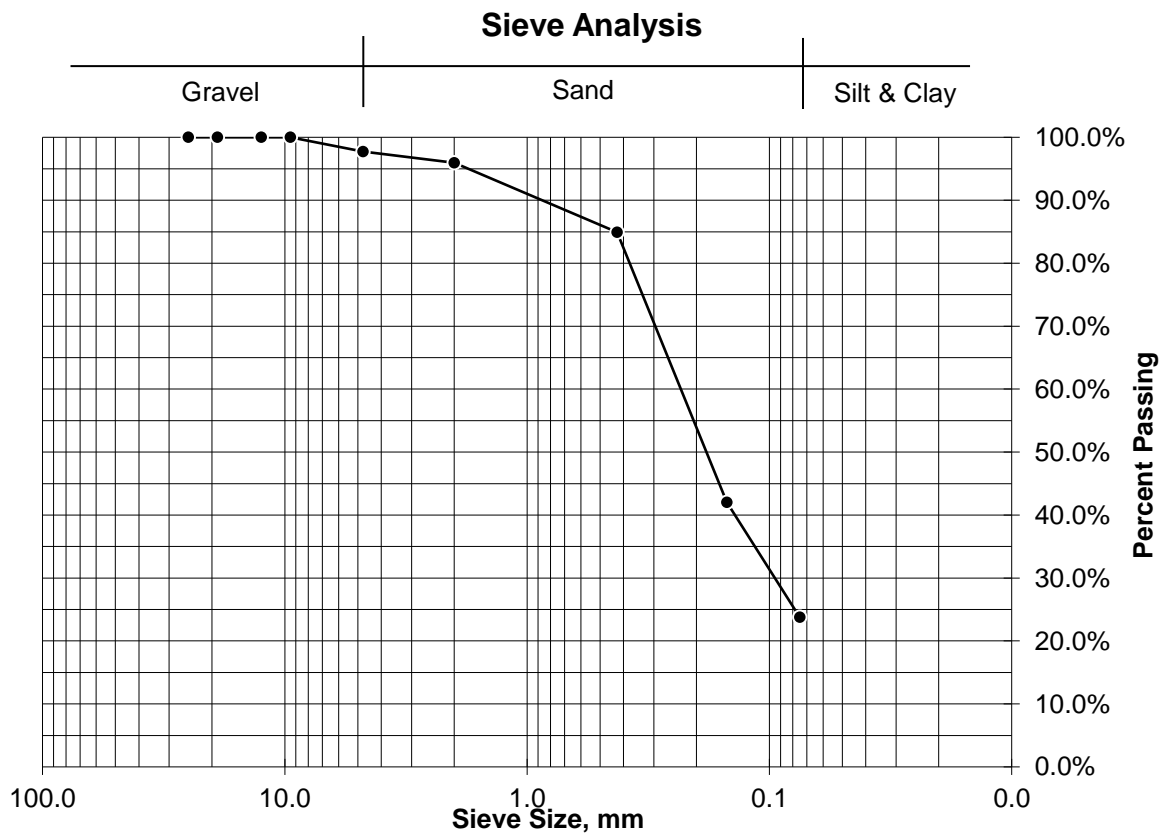
Prepared By: CBW

Sample ID DAA-18

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	2.08	2.3%	4.75	97.7%
No. 10	1.64	1.8%	2.00	96.0%
No. 40	10.19	11.0%	0.425	84.9%
No. 100	39.64	42.9%	0.15	42.0%
No. 200	16.87	18.3%	0.075	23.8%
Pan	0.63	0.7%		
Total	71.05	76.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-19

Sample Depth 6'-8'

Visual Sample Description Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	35
Pan Wt	192.73 grams
Pan + Soil (wet)	294.78 grams
Pan + Soil (dry)	279.51 grams
Natural Moisture Content	17.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 260.05 grams

Percent Passing No. 200 Sieve 22.4%

Pan + Soil retained on No. 4 sieve

(dry) 192.73 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/29/2019

Liquid Limit

No of Blows	19	26	33
Pan ID	10	7	72
Pan Wt	11.33	10.98	11.06
Pan + Soil (wet)	27.79	26.58	25.37
Pan + Soil (dry)	22.73	22.04	21.45
Moisture Content	44.4%	41.0%	37.7%
Liquid Limit	43	41	39
Liquid Limit	41		

Plastic Limit

Pan ID	82	13
Pan Weight	4.23	4.27
Pan + Soil (wet)	14.55	15.29
Pan + Soil (dry)	12.39	12.99
Moisture Content	26.5%	26.4%
Plastic Limit	26	
Plastic Index	15	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-19

Sample Depth 6'-8'

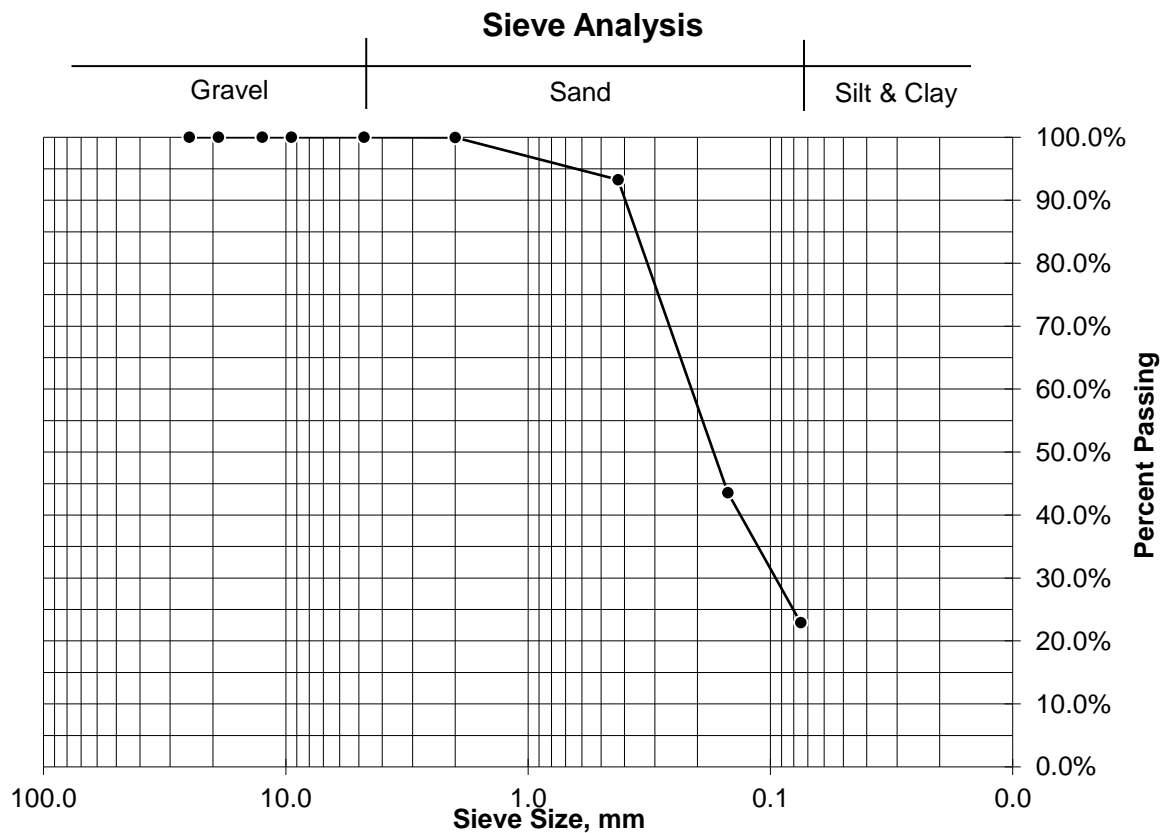
Mechanical Sieve Analysis: ASTM D 422



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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.04	0.0%	2.00	100.0%
No. 40	5.79	6.7%	0.425	93.3%
No. 100	43.16	49.7%	0.15	43.5%
No. 200	17.92	20.6%	0.075	22.9%
Pan	0.41	0.5%		
Total	67.32	77.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-20

Sample Depth 14'-16'

Visual Sample Description Brownish-gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	22
Pan Wt	189.03 grams
Pan + Soil (wet)	291.46 grams
Pan + Soil (dry)	280.94 grams
Natural Moisture Content	11.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 256.41 grams

Percent Passing No. 200 Sieve 26.7%

Pan + Soil retained on No. 4 sieve

(dry) 191.13 grams

Percent Passing No. 4 Sieve 97.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/23/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

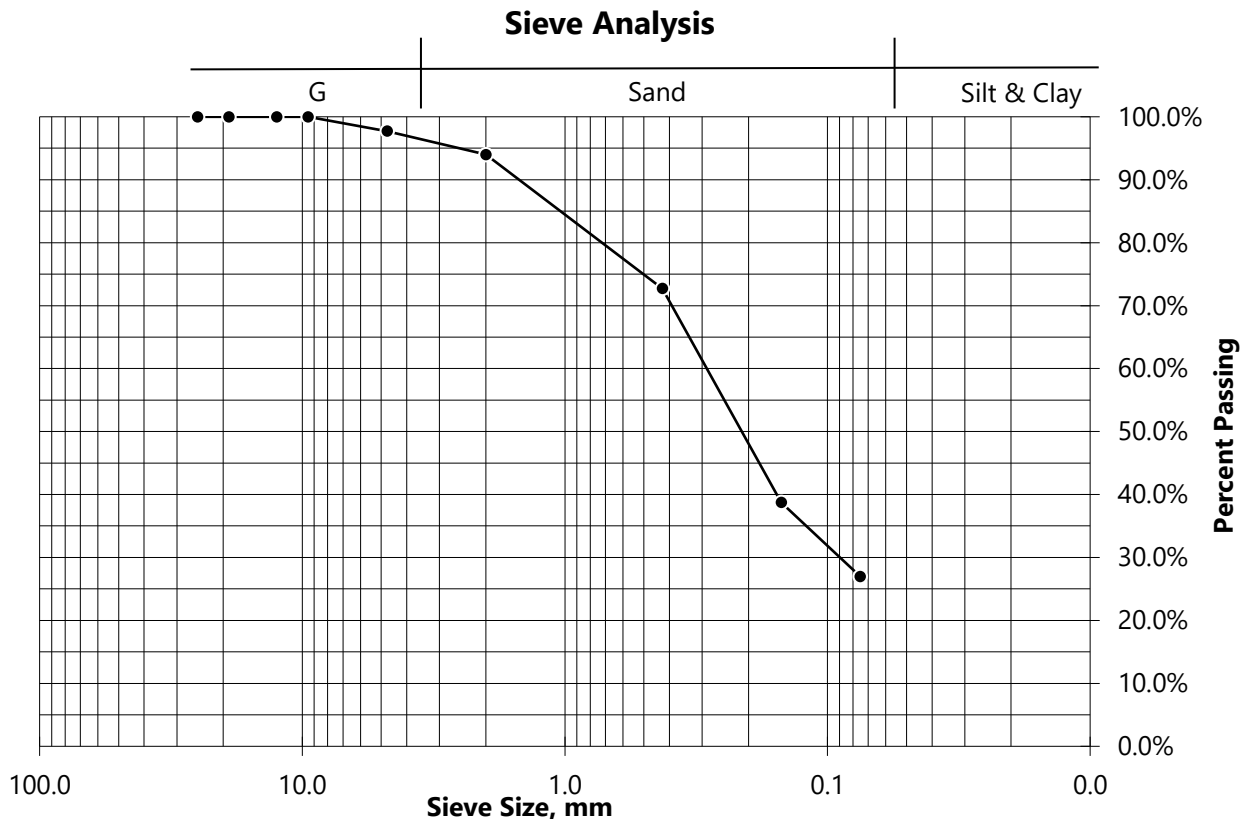
Prepared By: CBW

Sample ID DAA-20

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	2.10	2.3%	4.75	97.7%
No. 10	3.41	3.7%	2.00	94.0%
No. 40	19.56	21.3%	0.425	72.7%
No. 100	31.24	34.0%	0.15	38.7%
No. 200	10.81	11.8%	0.075	27.0%
Pan	0.21	0.2%		
Total	67.33	73.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-21

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	20
Pan Wt	189.93 grams
Pan + Soil (wet)	298.07 grams
Pan + Soil (dry)	284.10 grams
Natural Moisture Content	14.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 260.46 grams

Percent Passing No. 200 Sieve 25.1%

Pan + Soil retained on No. 4 sieve

(dry) 189.93 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/25/2019

Liquid Limit

No of Blows	16	23	31
Pan ID	72	70	10
Pan Wt	11.06	10.97	11.27
Pan + Soil (wet)	21.29	21.05	21.31
Pan + Soil (dry)	18.25	18.25	18.70
Moisture Content	42.2%	38.5%	35.1%
Liquid Limit	40	38	36
Liquid Limit	38		

Plastic Limit

Pan ID	4	313
Pan Weight	8.98	9.14
Pan + Soil (wet)	19.49	21.27
Pan + Soil (dry)	17.28	18.71
Moisture Content	26.6%	26.7%
Plastic Limit	27	
Plastic Index	11	

USCS Classification: ASTM D 2487

Group Symbol SM

Group Name Silty SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-21

Sample Depth 6'-8'

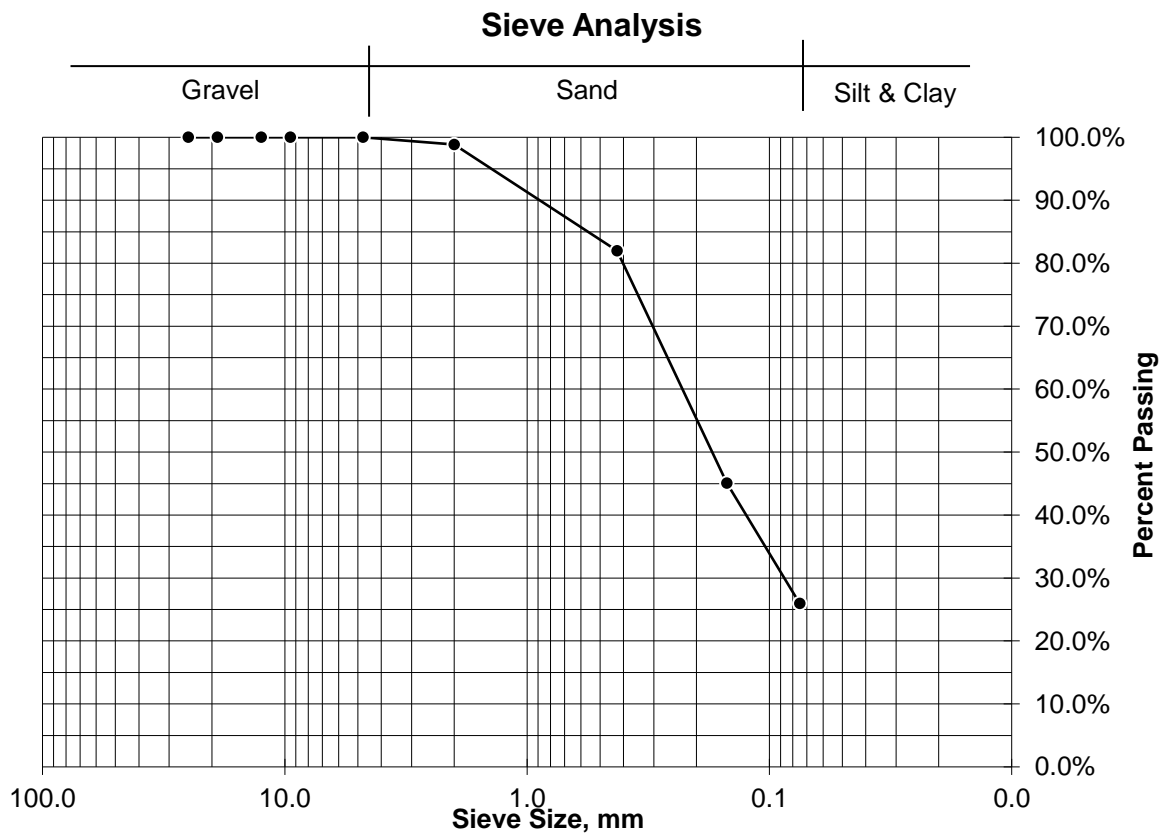
Mechanical Sieve Analysis: ASTM D 422



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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.06	1.1%	2.00	98.9%
No. 40	15.90	16.9%	0.425	82.0%
No. 100	34.75	36.9%	0.15	45.1%
No. 200	18.02	19.1%	0.075	26.0%
Pan	0.78	0.8%		
Total	70.51	74.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-22

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	123
Pan Wt	124.43 grams
Pan + Soil (wet)	233.34 grams
Pan + Soil (dry)	215.67 grams
Natural Moisture Content	19.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 188.44 grams

Percent Passing No. 200 Sieve 29.8%

Pan + Soil retained on No. 4 sieve

(dry) 124.97 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-22

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

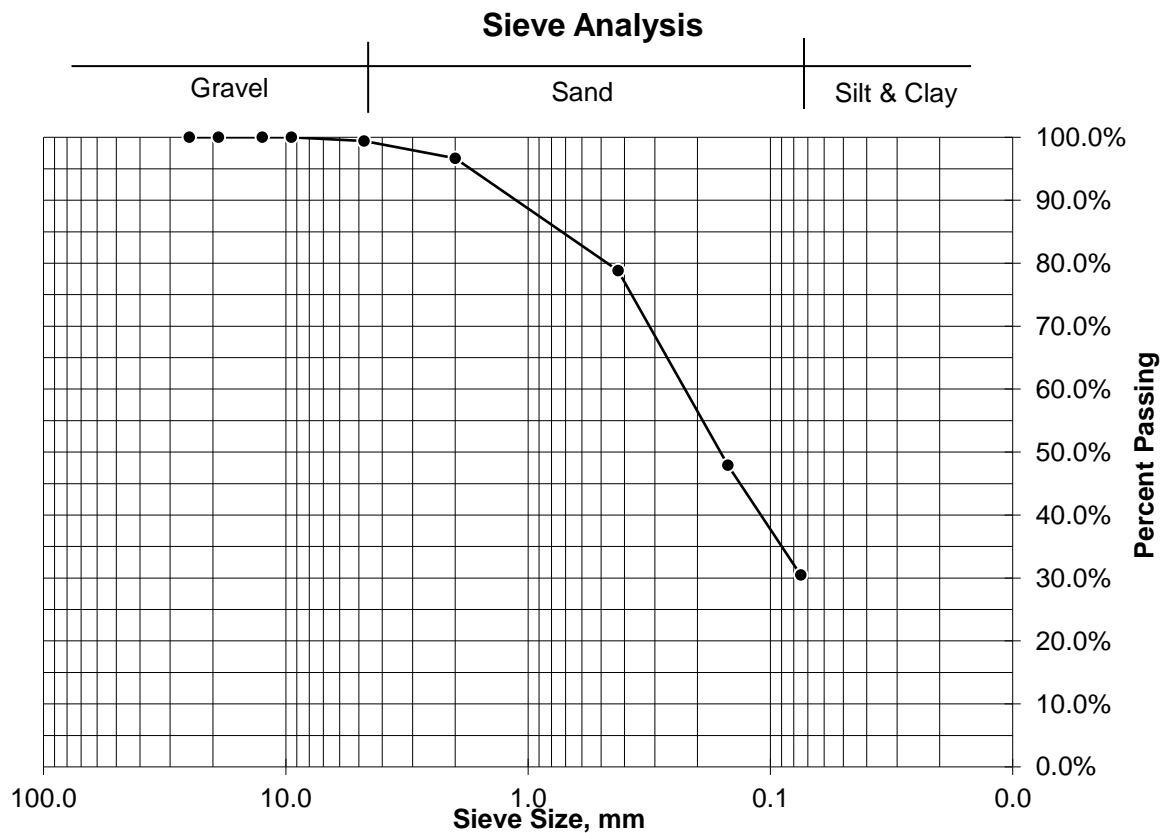


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Richmond, VA 23227

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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.54	0.6%	4.75	99.4%
No. 10	2.48	2.7%	2.00	96.7%
No. 40	16.28	17.8%	0.425	78.8%
No. 100	28.23	30.9%	0.15	47.9%
No. 200	15.90	17.4%	0.075	30.5%
Pan	0.57	0.6%		
Total	64.00	70.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-22

Sample Depth 10'-12'

Visual Sample Description Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	122
Pan Wt	123.30 grams
Pan + Soil (wet)	225.80 grams
Pan + Soil (dry)	208.05 grams
Natural Moisture Content	20.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 196.59 grams

Percent Passing No. 200 Sieve 13.5%

Pan + Soil retained on No. 4 sieve

(dry) 123.30 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-22

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

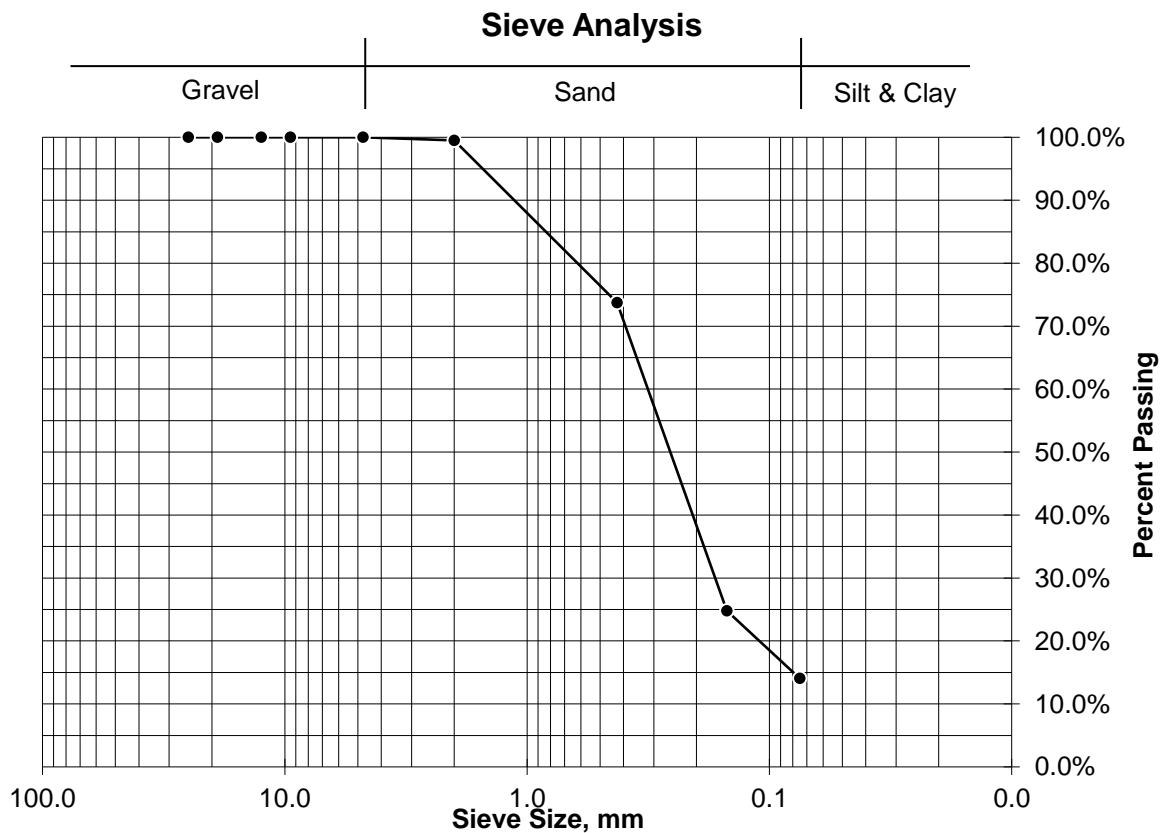


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.43	0.5%	2.00	99.5%
No. 40	21.84	25.8%	0.425	73.7%
No. 100	41.47	48.9%	0.15	24.8%
No. 200	9.09	10.7%	0.075	14.1%
Pan	0.46	0.5%		
Total	73.29	86.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-22

Sample Depth 35'-37'

Visual Sample Description Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	36
Pan Wt	193.74 grams
Pan + Soil (wet)	296.82 grams
Pan + Soil (dry)	289.12 grams
Natural Moisture Content	8.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 274.32 grams

Percent Passing No. 200 Sieve 15.5%

Pan + Soil retained on No. 4 sieve

(dry) 193.97 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-22

Sample Depth 35'-37'

Mechanical Sieve Analysis: ASTM D 422

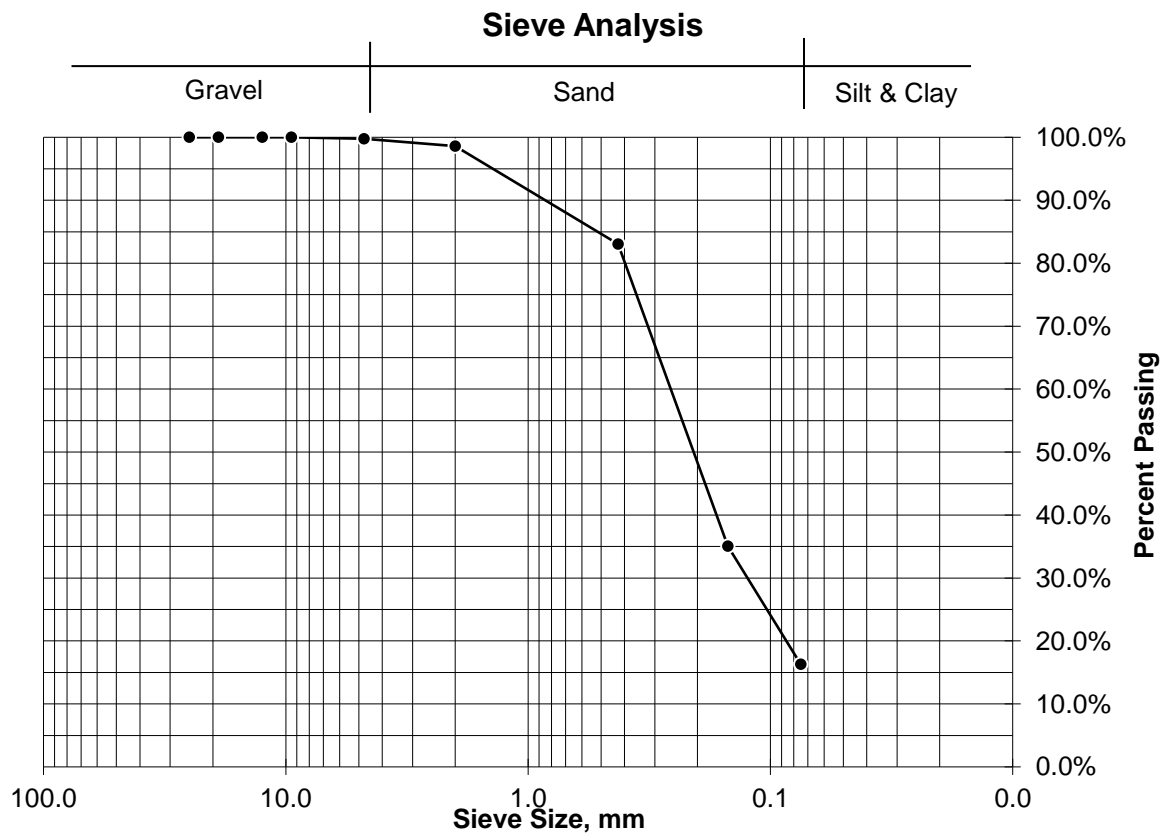


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.23	0.2%	4.75	99.8%
No. 10	1.11	1.2%	2.00	98.6%
No. 40	14.82	15.5%	0.425	83.1%
No. 100	45.77	48.0%	0.15	35.1%
No. 200	17.89	18.8%	0.075	16.3%
Pan	0.76	0.8%		
Total	80.58	84.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-23

Sample Depth 14'-16'

Visual Sample Description Reddish-brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	24
Pan Wt	186.13 grams
Pan + Soil (wet)	290.13 grams
Pan + Soil (dry)	271.17 grams
Natural Moisture Content	22.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 245.63 grams

Percent Passing No. 200 Sieve 30.0%

Pan + Soil retained on No. 4 sieve

(dry) 186.13 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/15/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

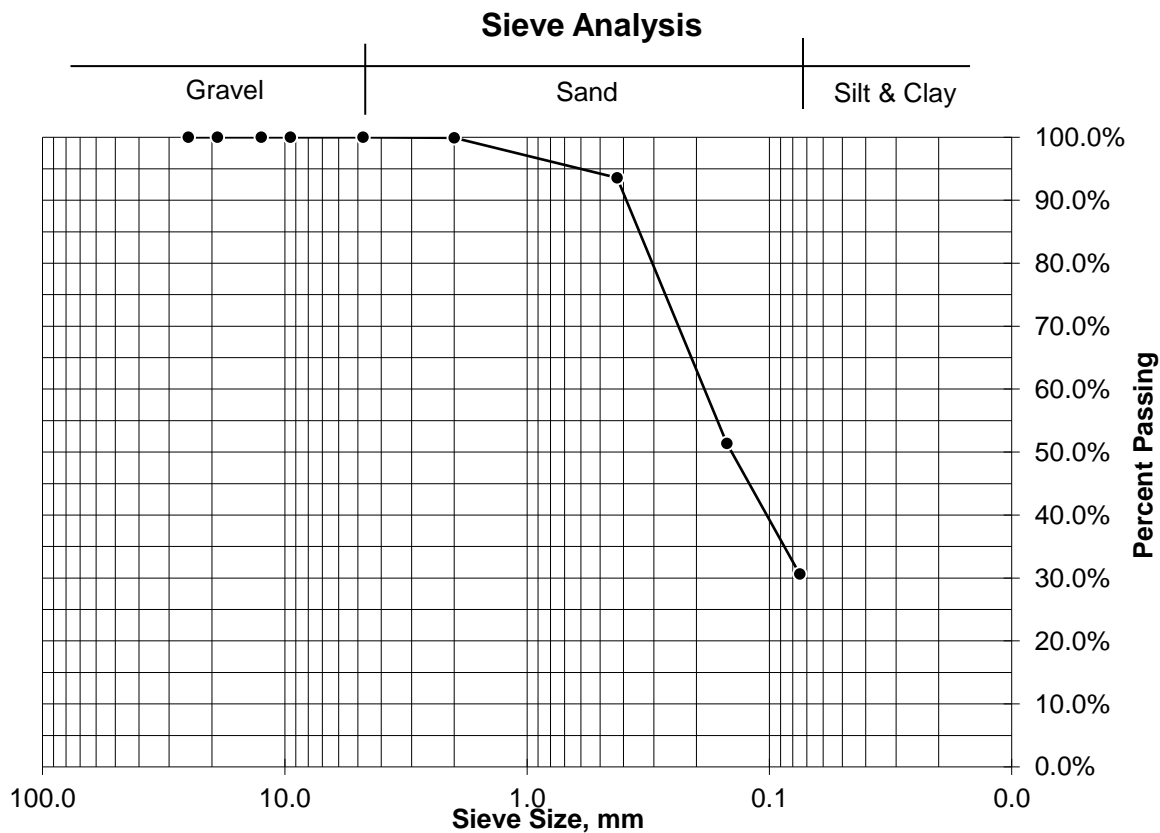
Prepared By: CBW

Sample ID DAA-23

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.09	0.1%	2.00	99.9%
No. 40	5.37	6.3%	0.425	93.6%
No. 100	35.87	42.2%	0.15	51.4%
No. 200	17.67	20.8%	0.075	30.6%
Pan	0.50	0.6%		
Total	59.50	70.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-23

Sample Depth 26'-28'

Visual Sample Description Brownish-Gray Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	11
Pan Wt	187.47 grams
Pan + Soil (wet)	305.65 grams
Pan + Soil (dry)	288.73 grams
Natural Moisture Content	16.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 272.53 grams

Percent Passing No. 200 Sieve 16.0%

Pan + Soil retained on No. 4 sieve

(dry) 187.47 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/22/2019

Liquid Limit

No of Blows			
Pan ID	Non-plastic		
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-23

Sample Depth 26'-28'

Mechanical Sieve Analysis: ASTM D 422

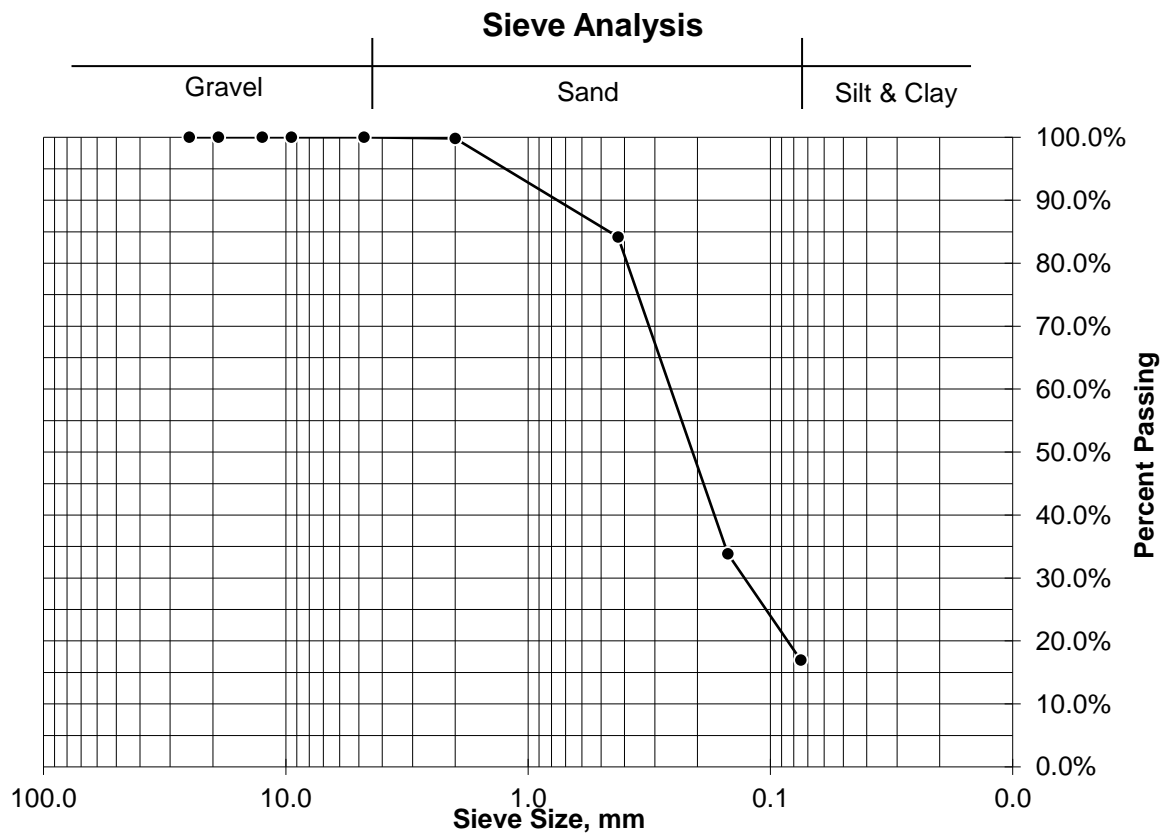


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.20	0.2%	2.00	99.8%
No. 40	15.84	15.6%	0.425	84.2%
No. 100	50.95	50.3%	0.15	33.8%
No. 200	17.08	16.9%	0.075	17.0%
Pan	0.95	0.9%		
Total	85.02	84.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-23

Sample Depth 28'-29.5'

Visual Sample Description Gray Silty SAND

Sample Received: 4/26/2019

Date Tested: 4/26/2019

Natural Moisture Content: ASTM D 2216

Pan ID	11
Pan Wt	187.50 grams
Pan + Soil (wet)	428.90 grams
Pan + Soil (dry)	394.65 grams
Natural Moisture Content	16.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 355.60 grams

Percent Passing No. 200 Sieve 18.9%

Pan + Soil retained on No. 4 sieve

(dry) 188.82 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

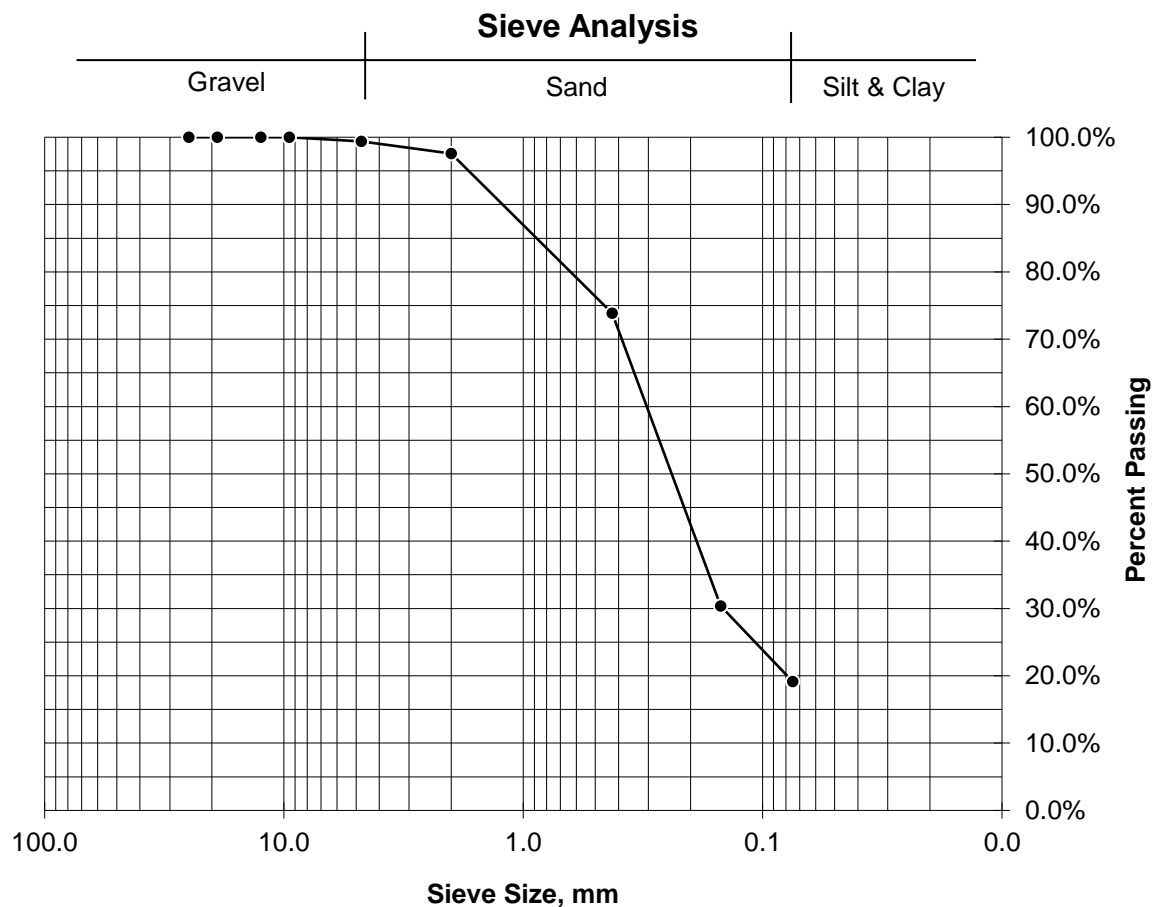
Prepared By: CBW

Sample ID DAA-23

Sample Depth 28'-29.5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Date Tested: Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	1.32	0.6%	4.75	99.4%
No. 10	3.67	1.8%	2.0	97.6%
No. 40	49.17	23.7%	0.425	73.9%
No. 100	90.09	43.5%	0.15	30.4%
No. 200	23.21	11.2%	0.075	19.2%
Pan	0.60	0.3%		
Total	168.06	81.1%		



Permeability Calculations
Green Ridge, Cumberland Landfill
DAA# 18020117-030102
Prepared By: CBW

Sample ID: DAA-23
 Sample Depth: 28'-29.5'
 Permeability Method: ASTM D5084
 Sample Length, in: 3.71
 Sample Diameter, in: 2.86
 Sample Condition: Undisturbed

Sample Received: 4/26/2019
 Date Tested: 4/26/2019

Moisture Content

Pan Wt 187.50 grams
 Pan + Soil (wet) 428.90 grams
 Pan + Soil (dry) 394.65 grams
 Moisture Content 16.5%

Dry Density

Soil (wet) 797.58 grams
 Wet Density 127.4 pcf
 Dry Density 109.4 pcf

Test Conditions

Backpressure, psi 40.0
 Cell Pressure, psi 50.0
 Influent Buret Area, cm² 0.03142
 Effluent Buret Area, cm² 0.76712
 Effective Stress, psi 10.0
 Pearment Liquid Temp.(°C):

Initial Data

Assumed Specific Gravity 2.65
 Percent Voids 33.9%
 Actual Volume of Voids 132.3 ml
 Porosity 33.9%
 Saturation 85.6%

Date Tested:

Permeability Trials

					Flow		
Time	Influent	Influent	Effluent	Effluent	Deviation	Gradient	Permeability, k
min	Head, cm	Flow, cm ³	Head, cm	Flow, cm ³	Ratio	mm-Hg	cm/sec

Failed, unable to get reading

Average Permeability #DIV/0! cm/sec Corrected for 20°C

Final Data

Assumed Specific Gravity	2.65		
Final Weight of Sample	836.42 grams	Final Sample Length, in:	3.67
Final Moisture Content	22.2%	Final Sample Diameter, in:	2.87
Percent Voids	33.6%	Wet Density	134.2 pcf
Actual Volume of Voids	130.7 ml	Dry Density	109.8 pcf
Porosity	33.6%		
Saturation	100.0%		

Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-25

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	25
Pan Wt	194.03 grams
Pan + Soil (wet)	296.42 grams
Pan + Soil (dry)	267.47 grams
Natural Moisture Content	39.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 237.91 grams

Percent Passing No. 200 Sieve 40.3%

Pan + Soil retained on No. 4 sieve

(dry) 194.52 grams

Percent Passing No. 4 Sieve 99.3%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 3/26/2019

Liquid Limit

No of Blows	19	24	35
Pan ID	169	201	96
Pan Wt	27.18	27.71	24.87
Pan + Soil (wet)	39.50	38.36	35.41
Pan + Soil (dry)	34.64	34.32	31.60
Moisture Content	65.1%	61.1%	56.6%
Liquid Limit	63	61	59
Liquid Limit	61		

Plastic Limit

Pan ID	73	74
Pan Weight	4.26	4.28
Pan + Soil (wet)	14.40	16.68
Pan + Soil (dry)	11.59	13.24
Moisture Content	38.3%	38.4%
Plastic Limit	38	
Plastic Index	23	

USCS Classification: ASTM D 2487

Group Symbol SM

Group Name Silty SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-25

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

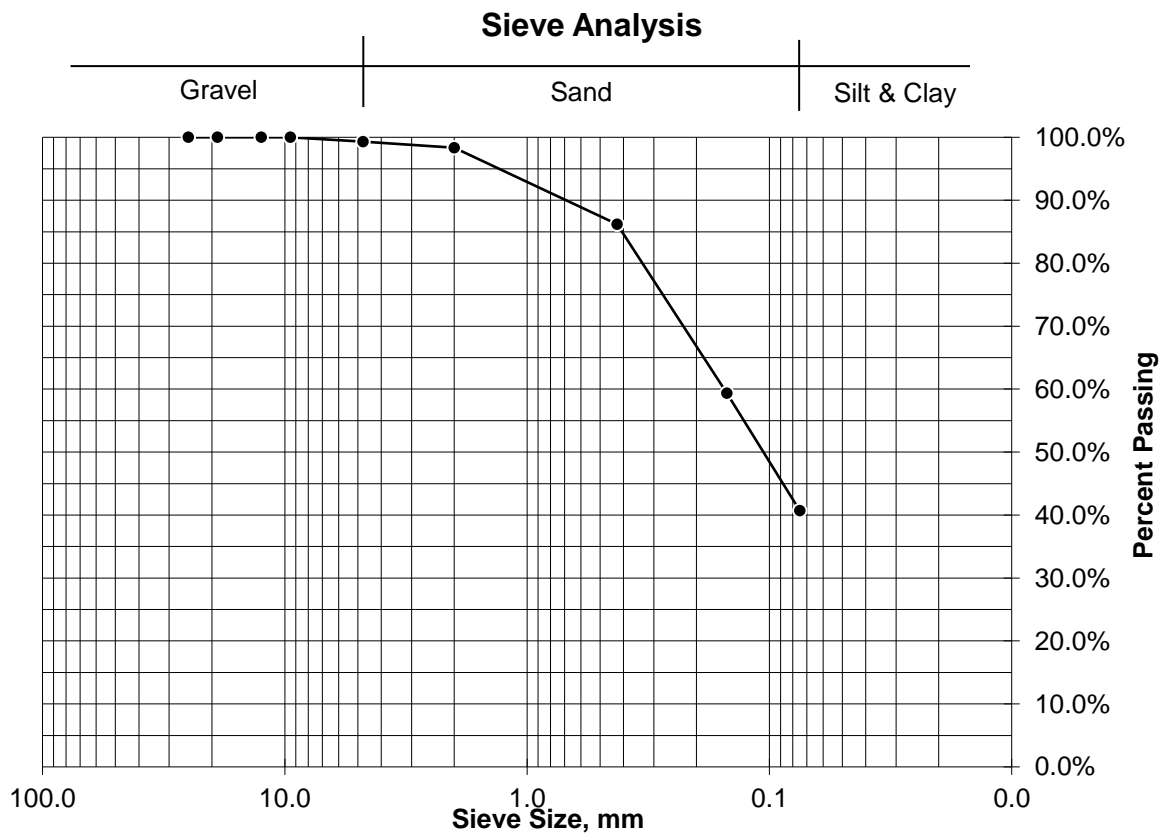


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.49	0.7%	4.75	99.3%
No. 10	0.71	1.0%	2.00	98.4%
No. 40	8.92	12.1%	0.425	86.2%
No. 100	19.72	26.9%	0.15	59.4%
No. 200	13.69	18.6%	0.075	40.7%
Pan	0.35	0.5%		
Total	43.88	59.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-25

Sample Depth 16'-18'

Visual Sample Description Light Brown Silty SAND

Sample Received: 3/19/2019

Date Tested: 3/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	110
Pan Wt	122.63 grams
Pan + Soil (wet)	231.01 grams
Pan + Soil (dry)	210.04 grams
Natural Moisture Content	24.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 182.18 grams

Percent Passing No. 200 Sieve 31.9%

Pan + Soil retained on No. 4 sieve

(dry) 128.16 grams

Percent Passing No. 4 Sieve 93.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/15/2019

Liquid Limit

No of Blows	16	26	32
Pan ID	1	64	96
Pan Wt	11.24	11.04	24.78
Pan + Soil (wet)	29.45	27.98	31.00
Pan + Soil (dry)	22.11	21.51	28.71
Moisture Content	67.6%	61.8%	58.2%
Liquid Limit	64	62	60
Liquid Limit	62		

Plastic Limit

Pan ID	78	81
Pan Weight	4.24	4.33
Pan + Soil (wet)	15.31	15.09
Pan + Soil (dry)	12.28	12.10
Moisture Content	37.7%	38.5%
Plastic Limit	38	
Plastic Index	24	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-25

Sample Depth 16'-18'

Mechanical Sieve Analysis: ASTM D 422

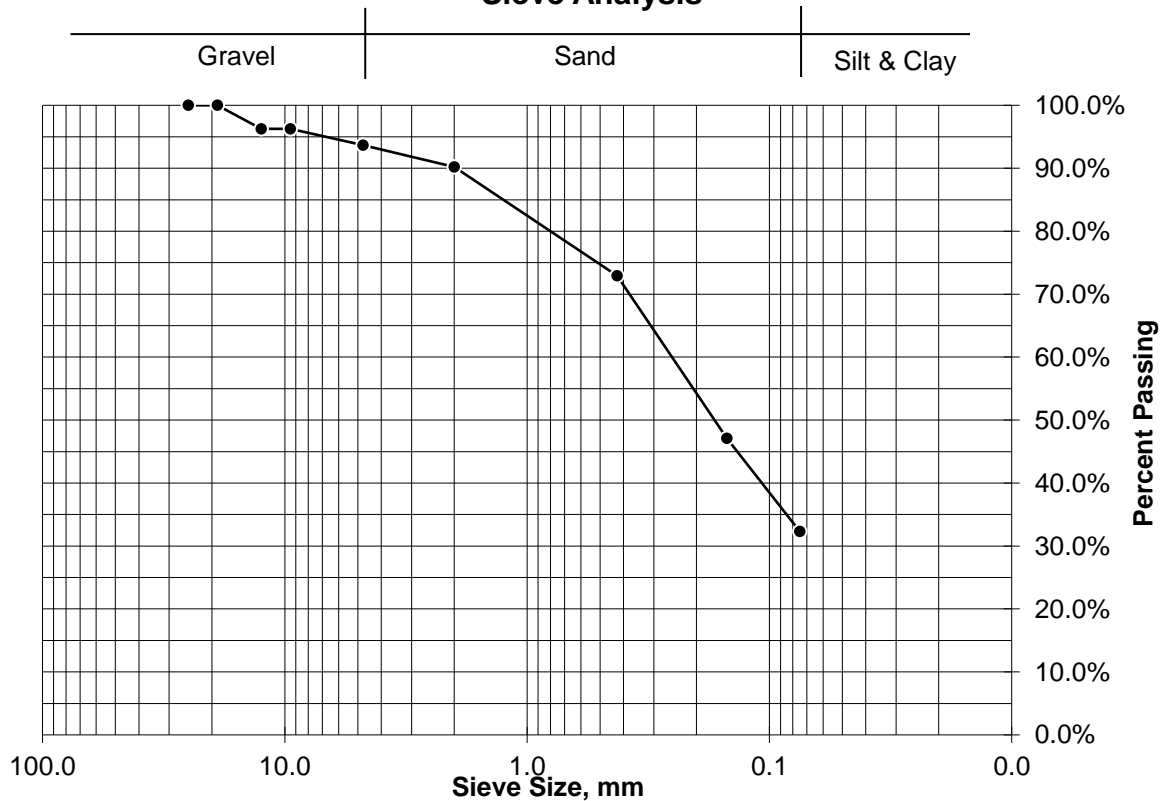


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	3.27	3.7%	12.5	96.3%
3/8"	0.00	0.0%	9.50	96.3%
No. 4	2.26	2.6%	4.75	93.7%
No. 10	3.03	3.5%	2.00	90.2%
No. 40	15.10	17.3%	0.425	72.9%
No. 100	22.59	25.8%	0.15	47.1%
No. 200	12.89	14.7%	0.075	32.3%
Pan	0.40	0.5%		
Total	59.54	68.1%		

Sieve Analysis



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-26

Sample Depth 2'-4'

Visual Sample Description Light Reddish-brown Elastic SILT

Sample Received: 4/17/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID 9
Pan Wt 189.24 grams
Pan + Soil (wet) 293.77 grams
Pan + Soil (dry) 263.10 grams
Natural Moisture Content 41.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 193.83 grams

Percent Passing No. 200 Sieve 93.8%

Pan + Soil retained on No. 4 sieve

(dry) 189.24 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows	15	27	34
Pan ID	61	63	10
Pan Wt	10.96	10.86	11.26
Pan + Soil (wet)	17.72	20.86	19.33
Pan + Soil (dry)	14.59	16.48	15.90
Moisture Content	86.2%	77.9%	73.9%
Liquid Limit	81	79	77
<i>Liquid Limit</i>	79		

Plastic Limit

Pan ID	74	22
Pan Weight	4.29	4.31
Pan + Soil (wet)	14.49	14.34
Pan + Soil (dry)	11.73	11.62
Moisture Content	37.1%	37.2%
<i>Plastic Limit</i>	37	
<i>Plastic Index</i>	42	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

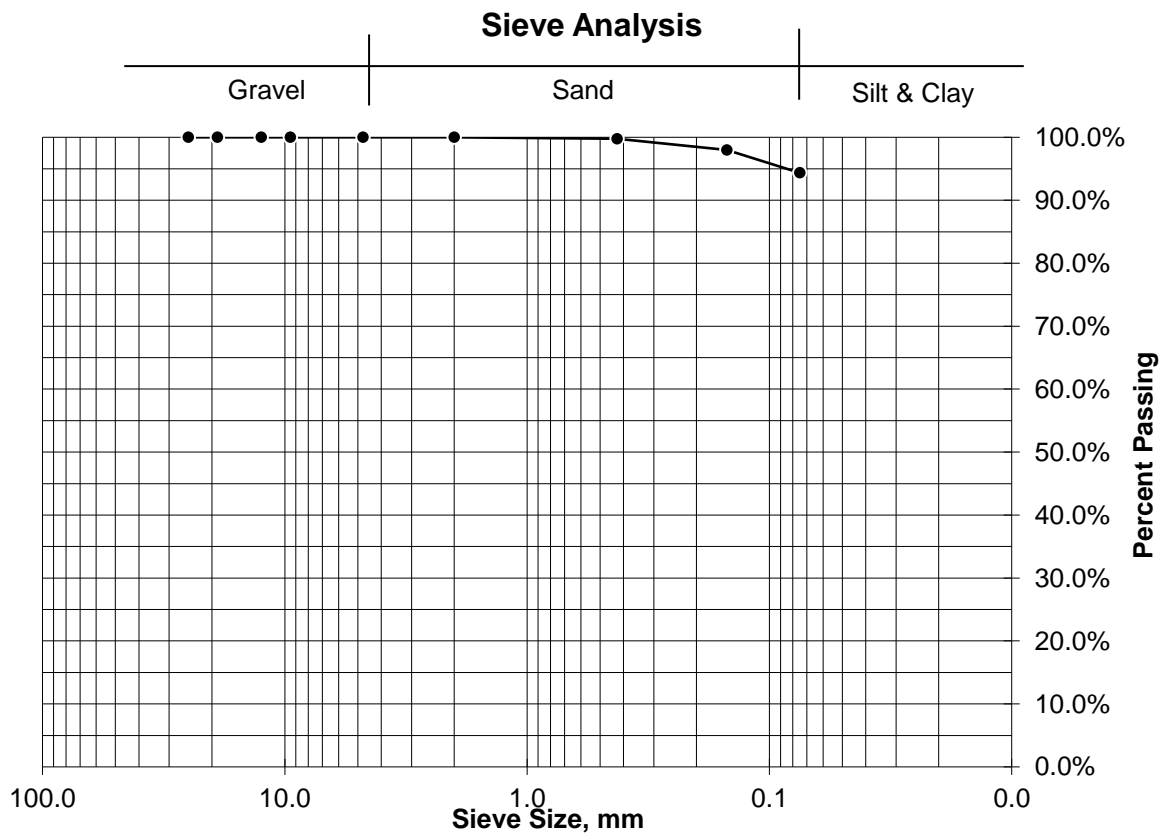
DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26
Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	0.18	0.2%	0.425	99.8%
No. 100	1.31	1.8%	0.15	98.0%
No. 200	2.68	3.6%	0.075	94.4%
Pan	0.41	0.6%		
Total	4.58	6.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 4'-6'

Visual Sample Description Light Brown Elastic SILT

Sample Received: 4/11/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	118
Pan Wt	122.25 grams
Pan + Soil (wet)	224.18 grams
Pan + Soil (dry)	197.03 grams
Natural Moisture Content	36.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 132.14 grams

Percent Passing No. 200 Sieve 86.8%

Pan + Soil retained on No. 4 sieve

(dry) 122.25 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/25/2019

Liquid Limit

No of Blows	19	28	30
Pan ID	1	96	64
Pan Wt	11.23	24.79	11.03
Pan + Soil (wet)	22.55	33.44	40.61
Pan + Soil (dry)	18.07	30.20	29.81
Moisture Content	65.5%	59.9%	57.5%
Liquid Limit	63	61	59
Liquid Limit	61		

Plastic Limit

Pan ID	352	353
Pan Weight	9.06	9.10
Pan + Soil (wet)	19.61	19.98
Pan + Soil (dry)	16.71	17.02
Moisture Content	37.9%	37.4%
Plastic Limit	38	
Plastic Index	23	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

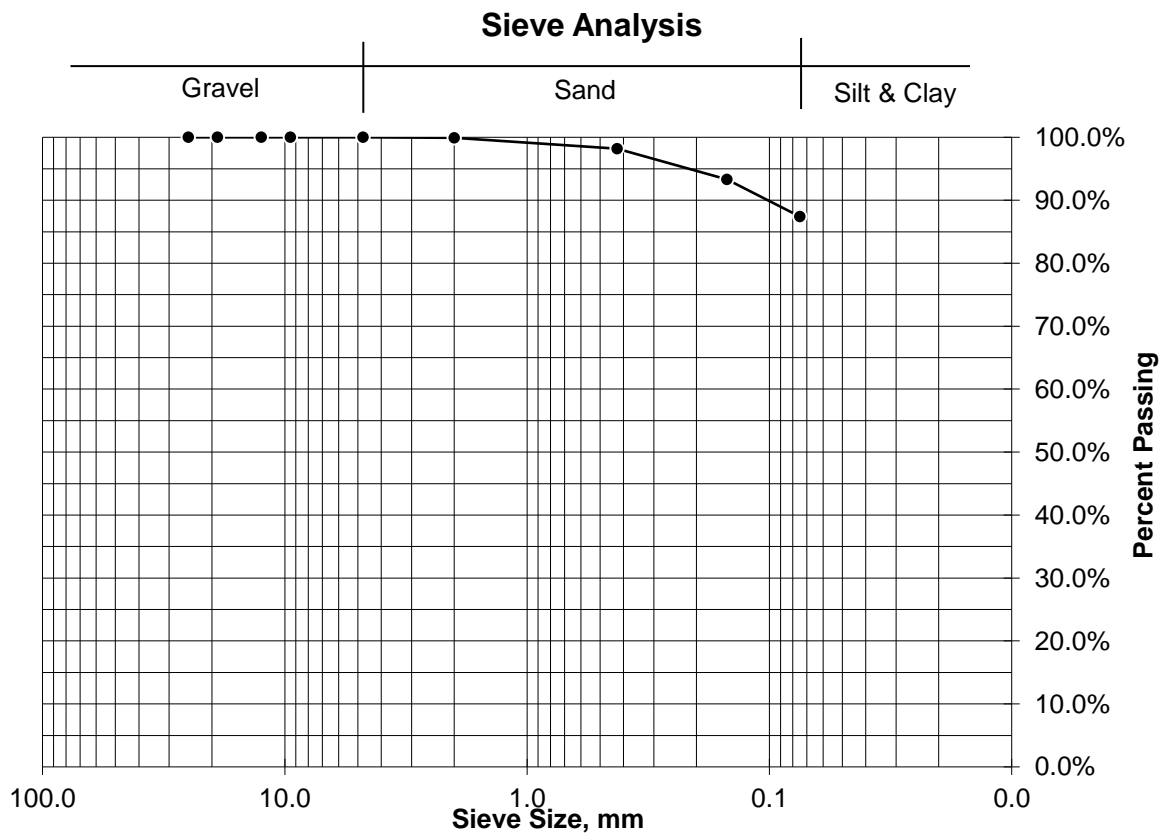


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.06	0.1%	2.00	99.9%
No. 40	1.30	1.7%	0.425	98.2%
No. 100	3.65	4.9%	0.15	93.3%
No. 200	4.39	5.9%	0.075	87.4%
Pan	0.45	0.6%		
Total	9.85	13.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 8'-10'

Visual Sample Description Light Brown SILT with Sand

Sample Received: 4/11/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	6
Pan Wt	195.32 grams
Pan + Soil (wet)	307.70 grams
Pan + Soil (dry)	277.87 grams
Natural Moisture Content	36.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 212.08 grams

Percent Passing No. 200 Sieve 79.7%

Pan + Soil retained on No. 4 sieve

(dry) 195.32 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **ML**

Group Name **SILT with Sand**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26

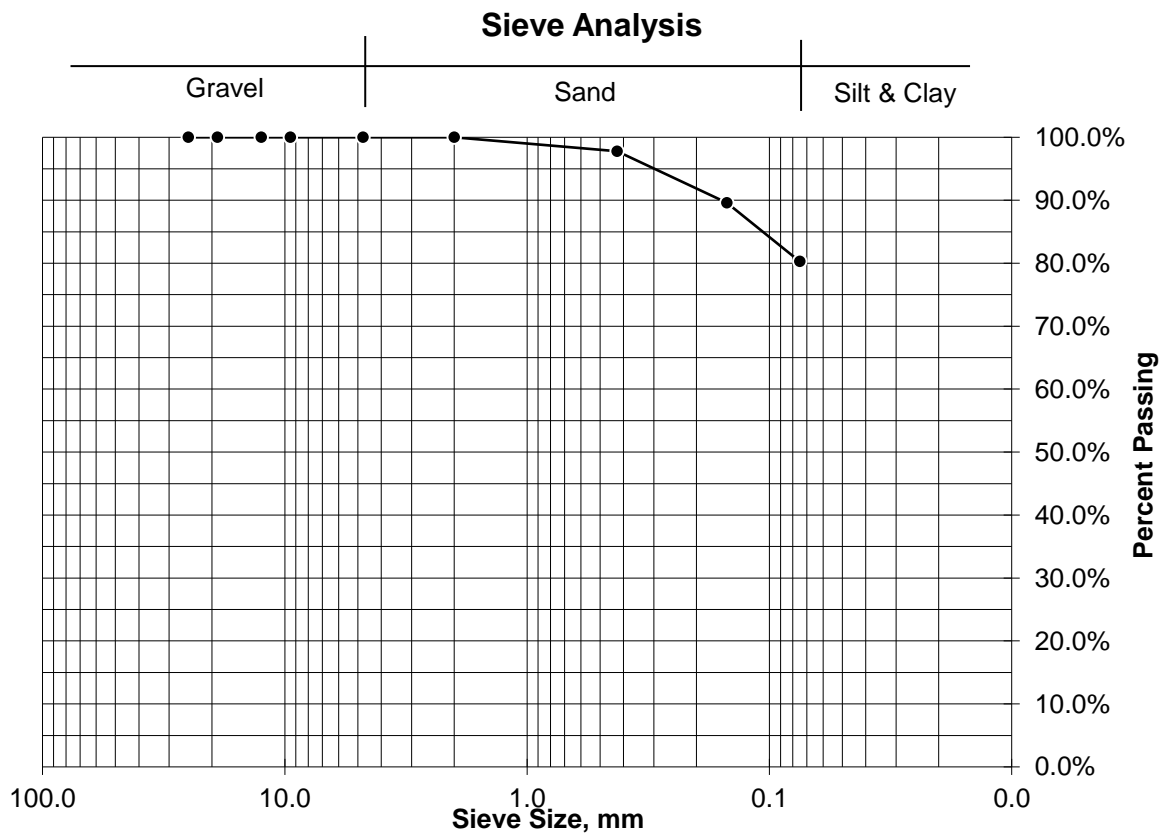
Sample Depth 8'-10'

Mechanical Sieve Analysis: ASTM D 422

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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	1.82	2.2%	0.425	97.8%
No. 100	6.75	8.2%	0.15	89.6%
No. 200	7.71	9.3%	0.075	80.3%
Pan	0.48	0.6%		
Total	16.76	20.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 18'-20'

Visual Sample Description Light Brown Elastic SILT with Sand

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	26
Pan Wt	194.57 grams
Pan + Soil (wet)	323.67 grams
Pan + Soil (dry)	282.99 grams
Natural Moisture Content	46.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 220.82 grams

Percent Passing No. 200 Sieve 70.3%

Pan + Soil retained on No. 4 sieve

(dry) 194.75 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows	16	23	31
Pan ID	107	64	70
Pan Wt	25.10	10.98	10.99
Pan + Soil (wet)	39.42	27.99	39.40
Pan + Soil (dry)	33.54	21.32	28.70
Moisture Content	69.7%	64.5%	60.4%
Liquid Limit	66	64	62
Liquid Limit	64		

Plastic Limit

Pan ID	354	4
Pan Weight	9.17	9.06
Pan + Soil (wet)	20.46	19.76
Pan + Soil (dry)	16.63	16.11
Moisture Content	51.3%	51.8%
Plastic Limit	52	
Plastic Index	12	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT with Sand

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26

Sample Depth 18'-20'

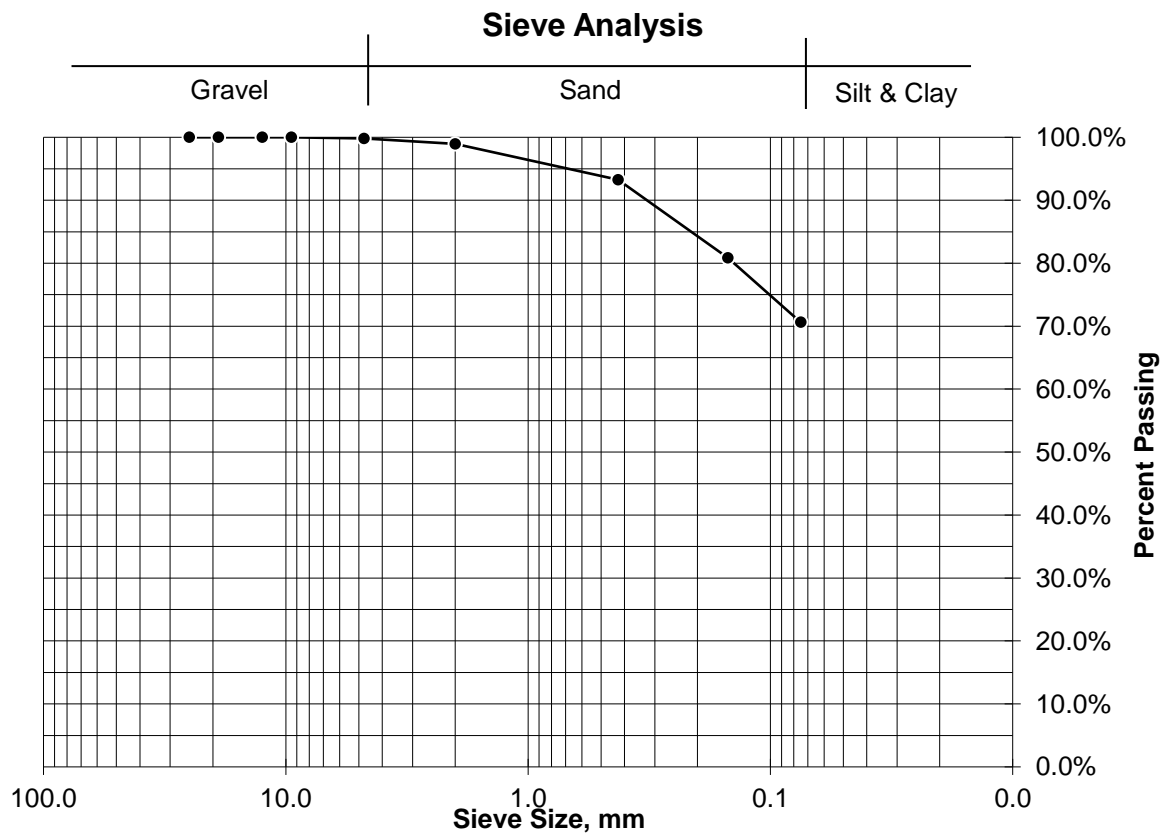
Mechanical Sieve Analysis: ASTM D 422



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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.18	0.2%	4.75	99.8%
No. 10	0.74	0.8%	2.00	99.0%
No. 40	5.03	5.7%	0.425	93.3%
No. 100	10.99	12.4%	0.15	80.8%
No. 200	9.04	10.2%	0.075	70.6%
Pan	0.27	0.3%		
Total	26.25	29.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 20'-22'

Visual Sample Description Light Brown Elastic SILT

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	124
Pan Wt	124.38 grams
Pan + Soil (wet)	252.16 grams
Pan + Soil (dry)	204.84 grams
Natural Moisture Content	58.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 133.77 grams

Percent Passing No. 200 Sieve 88.3%

Pan + Soil retained on No. 4 sieve

(dry) 124.38 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/26/2019

Liquid Limit

No of Blows	17	21	32
Pan ID	91	62	108
Pan Wt	24.52	10.87	33.14
Pan + Soil (wet)	36.06	27.36	41.26
Pan + Soil (dry)	31.22	20.68	38.11
Moisture Content	72.3%	68.1%	63.3%
Liquid Limit	69	67	65
Liquid Limit	67		

Plastic Limit

Pan ID	313	352
Pan Weight	9.14	9.05
Pan + Soil (wet)	23.99	19.79
Pan + Soil (dry)	18.74	15.99
Moisture Content	54.7%	54.8%
Plastic Limit	55	
Plastic Index	12	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

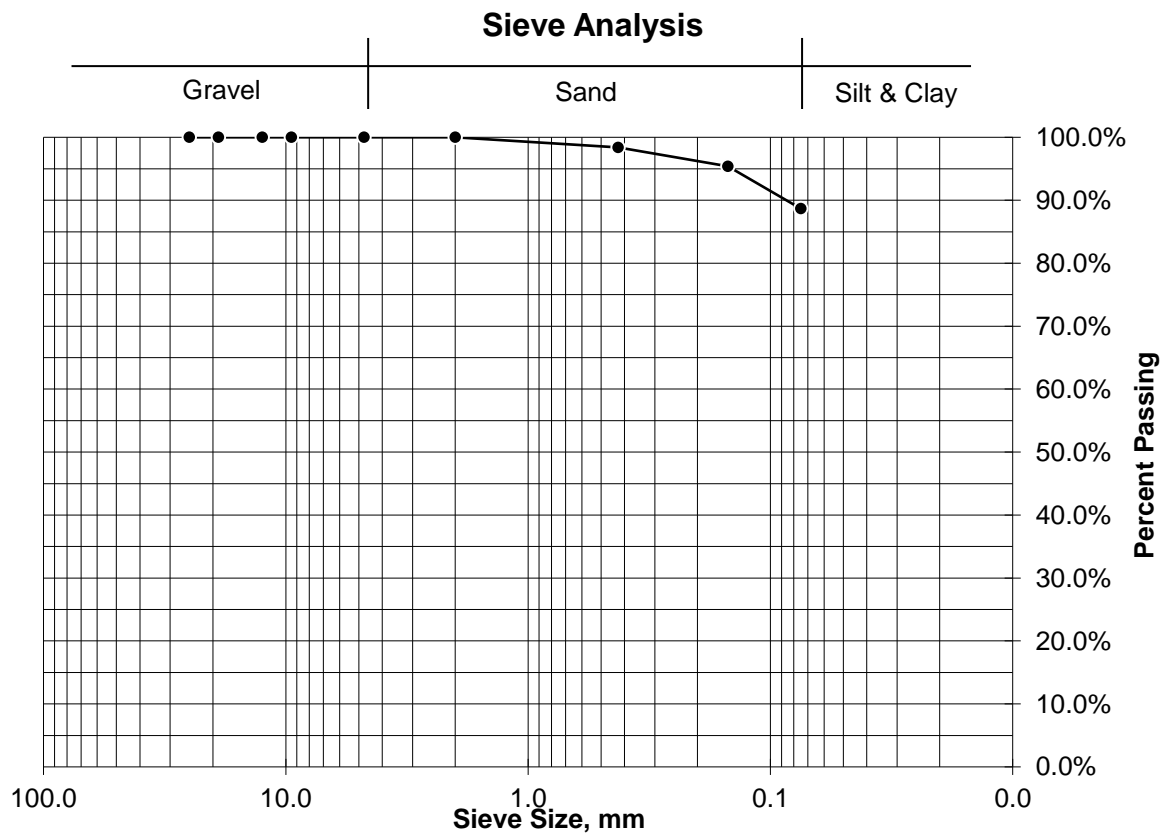
DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26
Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	1.31	1.6%	0.425	98.4%
No. 100	2.40	3.0%	0.15	95.4%
No. 200	5.40	6.7%	0.075	88.7%
Pan	0.28	0.3%		
Total	9.39	11.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



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Sample ID DAA-26

Sample Depth 22'-24'

Visual Sample Description Light Brown Elastic SILT with Sand

Sample Received: 4/11/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	100
Pan Wt	123.77 grams
Pan + Soil (wet)	224.48 grams
Pan + Soil (dry)	186.94 grams
Natural Moisture Content	59.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 135.86 grams

Percent Passing No. 200 Sieve 80.9%

Pan + Soil retained on No. 4 sieve

(dry) 123.77 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/25/2019

Liquid Limit

No of Blows	17	26	33
Pan ID	98	109	6
Pan Wt	30.31	25.03	11.17
Pan + Soil (wet)	40.96	38.05	28.39
Pan + Soil (dry)	36.70	33.10	22.07
Moisture Content	66.7%	61.3%	58.0%
Liquid Limit	64	62	60
Liquid Limit	62		

Plastic Limit

Pan ID	2	4
Pan Weight	9.04	9.06
Pan + Soil (wet)	19.64	21.14
Pan + Soil (dry)	16.30	17.36
Moisture Content	46.0%	45.5%
Plastic Limit	46	
Plastic Index	16	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Elastic SILT with Sand

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26

Sample Depth 22'-24'

Mechanical Sieve Analysis: ASTM D 422

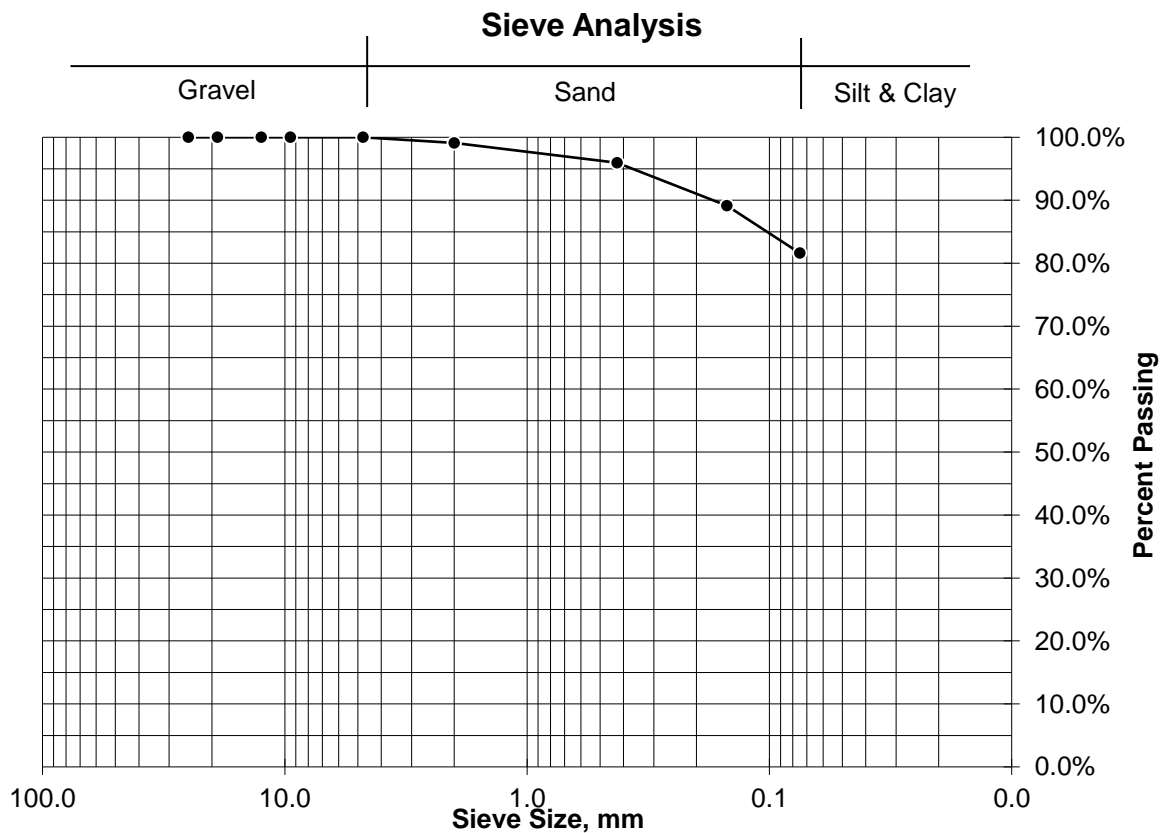


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.57	0.9%	2.00	99.1%
No. 40	1.99	3.2%	0.425	95.9%
No. 100	4.31	6.8%	0.15	89.1%
No. 200	4.74	7.5%	0.075	81.6%
Pan	0.47	0.7%		
Total	12.08	19.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
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Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 24'-26'

Visual Sample Description Light Brown Elastic SILT

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	37
Pan Wt	193.60 grams
Pan + Soil (wet)	302.92 grams
Pan + Soil (dry)	261.86 grams
Natural Moisture Content	60.2%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 202.27 grams

Percent Passing No. 200 Sieve 87.3%

Pan + Soil retained on No. 4 sieve

(dry) 193.60 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/26/2019

Liquid Limit

No of Blows	16	21	31
Pan ID	6	9	93
Pan Wt	11.18	11.11	30.11
Pan + Soil (wet)	32.28	28.61	46.24
Pan + Soil (dry)	23.24	21.37	39.87
Moisture Content	74.9%	70.6%	65.3%
Liquid Limit	71	69	67
Liquid Limit	69		

Plastic Limit

Pan ID	317	353
Pan Weight	8.08	9.13
Pan + Soil (wet)	18.44	19.36
Pan + Soil (dry)	14.87	15.84
Moisture Content	52.6%	52.5%
Plastic Limit	53	
Plastic Index	16	

USCS Classification: ASTM D 2487

Group Symbol **MH**

Group Name **Elastic SILT**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

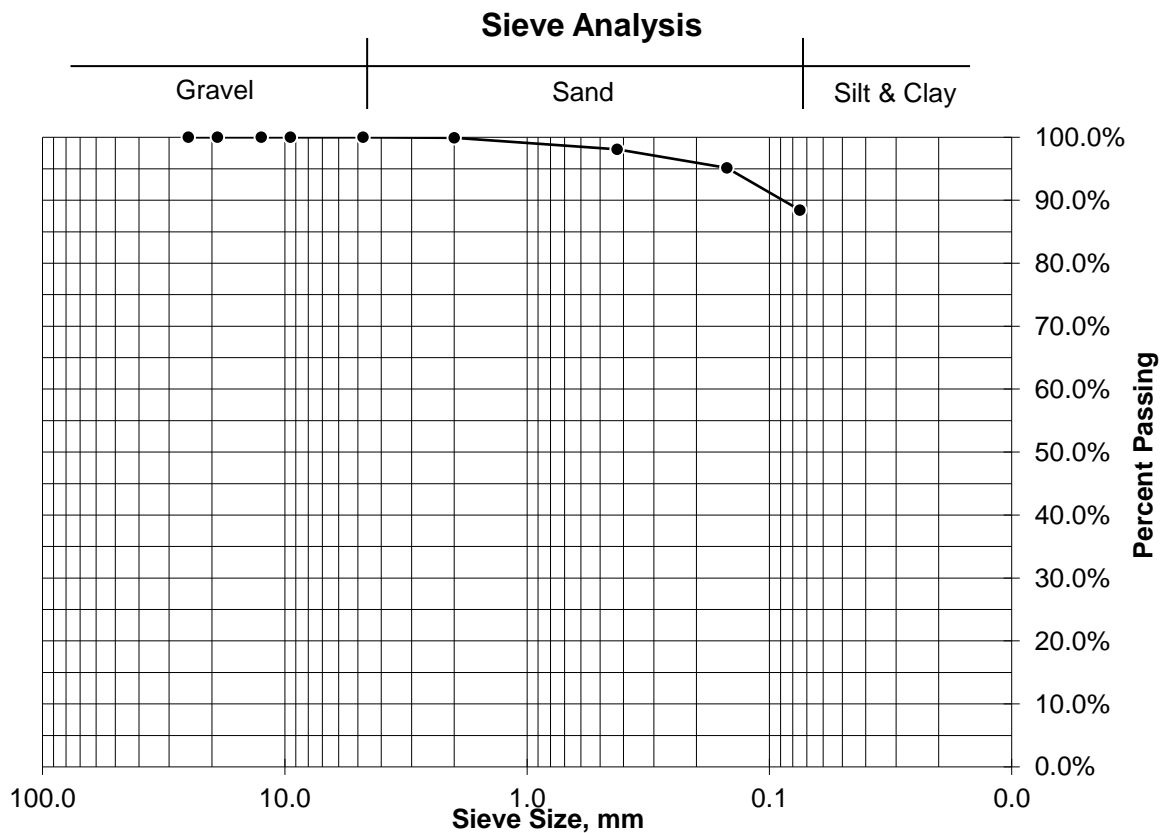
DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26
Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.06	0.1%	2.00	99.9%
No. 40	1.26	1.8%	0.425	98.1%
No. 100	2.01	2.9%	0.15	95.1%
No. 200	4.55	6.7%	0.075	88.5%
Pan	0.72	1.1%		
Total	8.60	12.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 28'-30'

Visual Sample Description Light Brown Sandy Elastic SILT

Sample Received: 4/17/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	11
Pan Wt	187.45 grams
Pan + Soil (wet)	294.74 grams
Pan + Soil (dry)	258.02 grams
Natural Moisture Content	52.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 214.44 grams

Percent Passing No. 200 Sieve 61.8%

Pan + Soil retained on No. 4 sieve

(dry) 187.45 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/3/2019

Liquid Limit

No of Blows	20	24	32
Pan ID	6	63	69
Pan Wt	11.20	10.83	10.96
Pan + Soil (wet)	21.84	20.02	19.57
Pan + Soil (dry)	18.09	16.91	16.78
Moisture Content	54.5%	51.2%	47.9%
Liquid Limit	53	51	49
Liquid Limit	51		

Plastic Limit

Pan ID	33	52
Pan Weight	2.40	2.39
Pan + Soil (wet)	9.45	9.69
Pan + Soil (dry)	7.53	7.72
Moisture Content	37.4%	37.0%
Plastic Limit	37	
Plastic Index	14	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

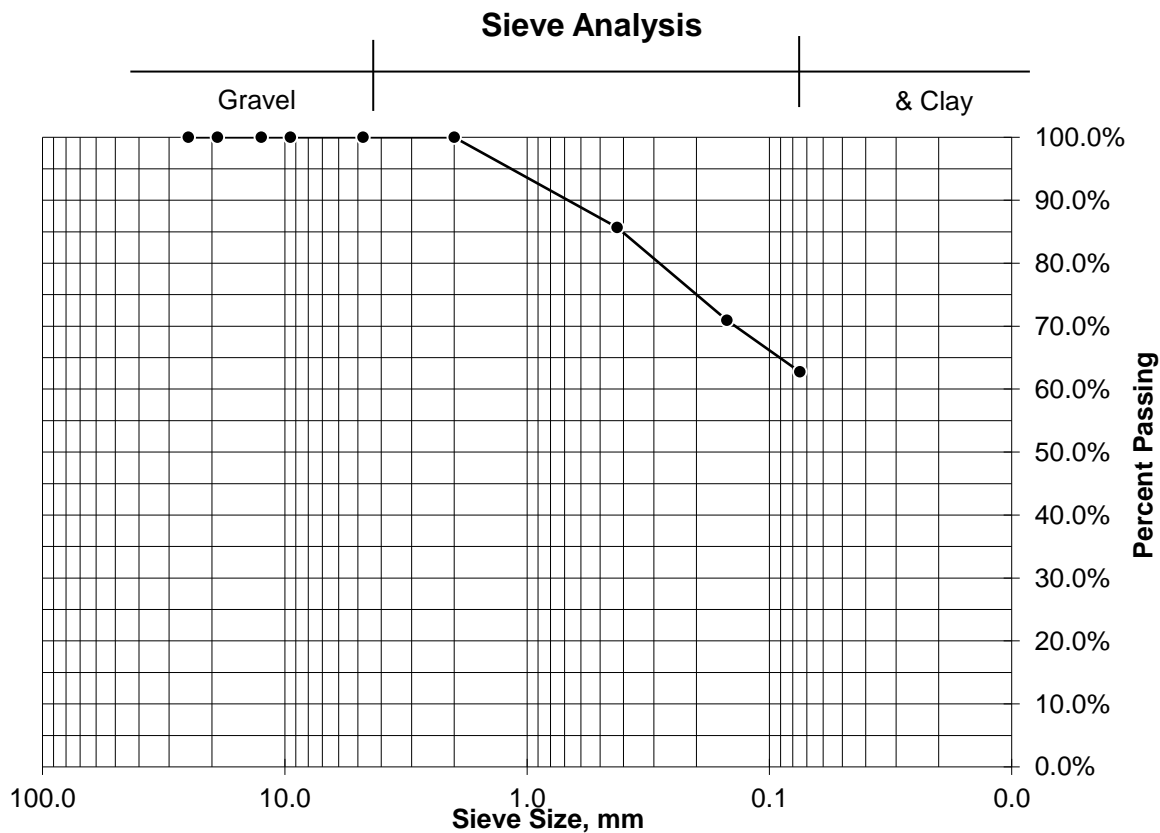
Prepared By: CBW

Sample ID DAA-26

Sample Depth 28'-30'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	10.11	14.3%	0.425	85.7%
No. 100	10.38	14.7%	0.15	71.0%
No. 200	5.79	8.2%	0.075	62.8%
Pan	0.68	1.0%		
Total	26.96	38.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-26

Sample Depth 34'-36'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	42
Pan Wt	192.29 grams
Pan + Soil (wet)	306.28 grams
Pan + Soil (dry)	282.57 grams
Natural Moisture Content	26.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 253.65 grams

Percent Passing No. 200 Sieve 32.0%

Pan + Soil retained on No. 4 sieve

(dry) 205.44 grams

Percent Passing No. 4 Sieve 85.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows	17	21	33
Pan ID	91	65	98
Pan Wt	24.52	10.99	30.34
Pan + Soil (wet)	33.03	28.80	33.17
Pan + Soil (dry)	29.87	22.44	32.22
Moisture Content	59.1%	55.5%	50.5%
Liquid Limit	56	54	52
Liquid Limit	54		

Plastic Limit

Pan ID	2	313
Pan Weight	9.02	9.14
Pan + Soil (wet)	20.85	20.02
Pan + Soil (dry)	17.34	16.79
Moisture Content	42.2%	42.2%
Plastic Limit	42	
Plastic Index	12	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-26

Sample Depth 34'-36'

Mechanical Sieve Analysis: ASTM D 422



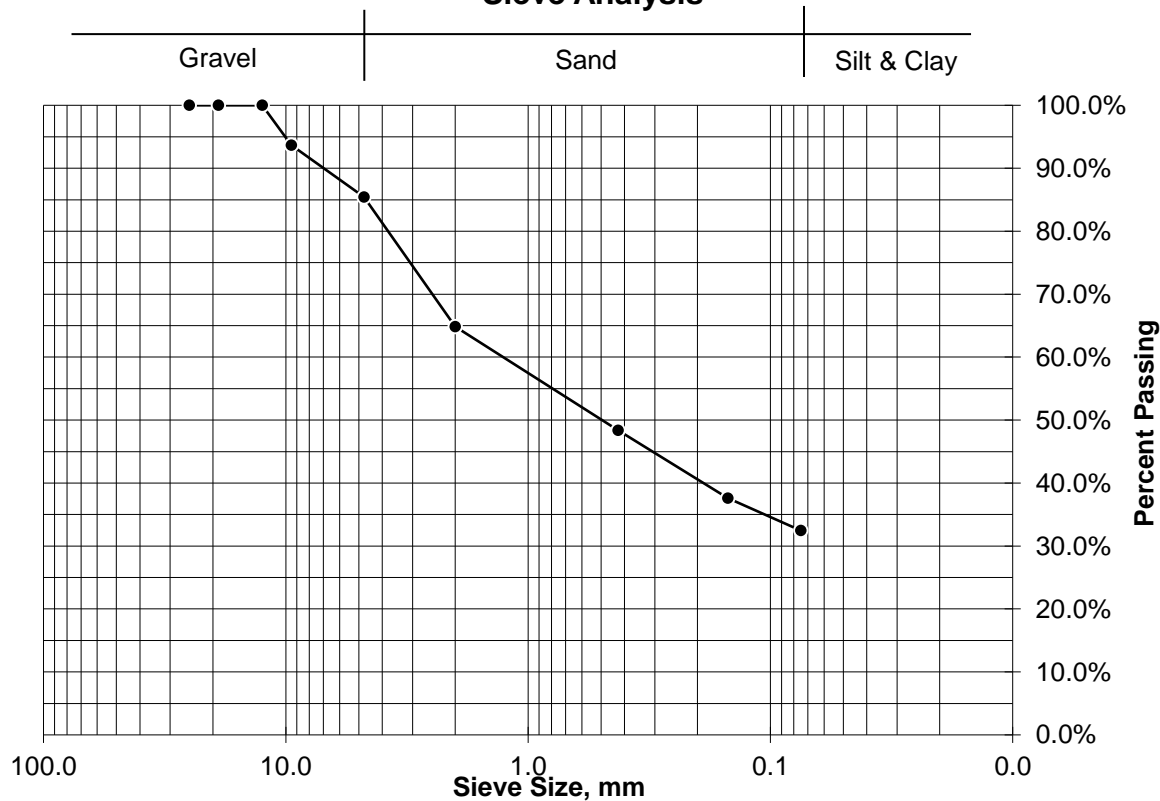
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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	5.73	6.3%	9.50	93.7%
No. 4	7.42	8.2%	4.75	85.4%
No. 10	18.59	20.6%	2.00	64.8%
No. 40	14.88	16.5%	0.425	48.4%
No. 100	9.70	10.7%	0.15	37.6%
No. 200	4.65	5.2%	0.075	32.5%
Pan	0.38	0.4%		
Total	61.35	68.0%		

Sieve Analysis



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-27

Sample Depth 2'-4'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/11/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	21
Pan Wt	193.79 grams
Pan + Soil (wet)	357.07 grams
Pan + Soil (dry)	345.85 grams
Natural Moisture Content	7.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 310.60 grams

Percent Passing No. 200 Sieve 23.2%

Pan + Soil retained on No. 4 sieve

(dry) 193.79 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-27

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

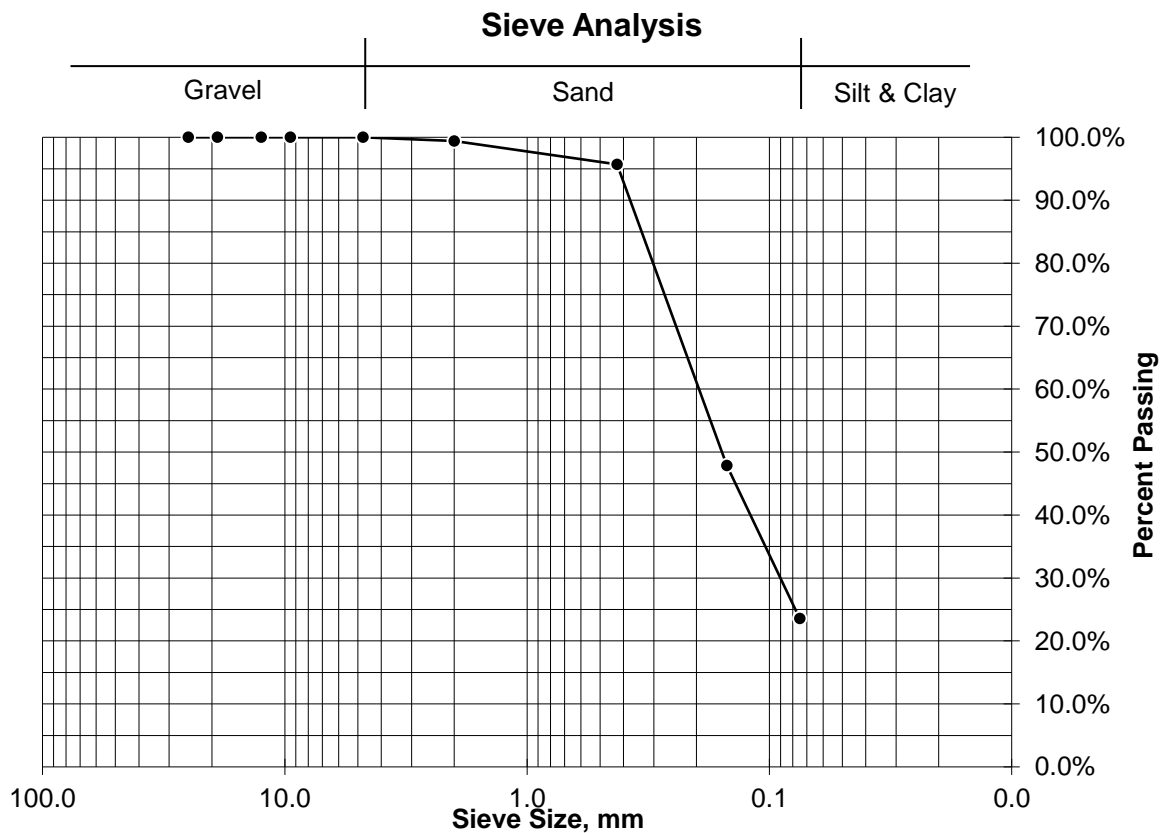


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Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.93	0.6%	2.00	99.4%
No. 40	5.61	3.7%	0.425	95.7%
No. 100	72.74	47.8%	0.15	47.9%
No. 200	36.94	24.3%	0.075	23.6%
Pan	0.59	0.4%		
Total	116.81	76.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-27

Sample Depth 14'-16'

Visual Sample Description Light Brownish-gray Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	29
Pan Wt	191.85 grams
Pan + Soil (wet)	349.47 grams
Pan + Soil (dry)	332.37 grams
Natural Moisture Content	12.2%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	282.63 grams
Percent Passing No. 200 Sieve	35.4%
Pan + Soil retained on No. 4 sieve	
(dry)	192.16 grams
Percent Passing No. 4 Sieve	99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/23/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			

Liquid Limit

Liquid Limit

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		

Plastic Limit

Plastic Index

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

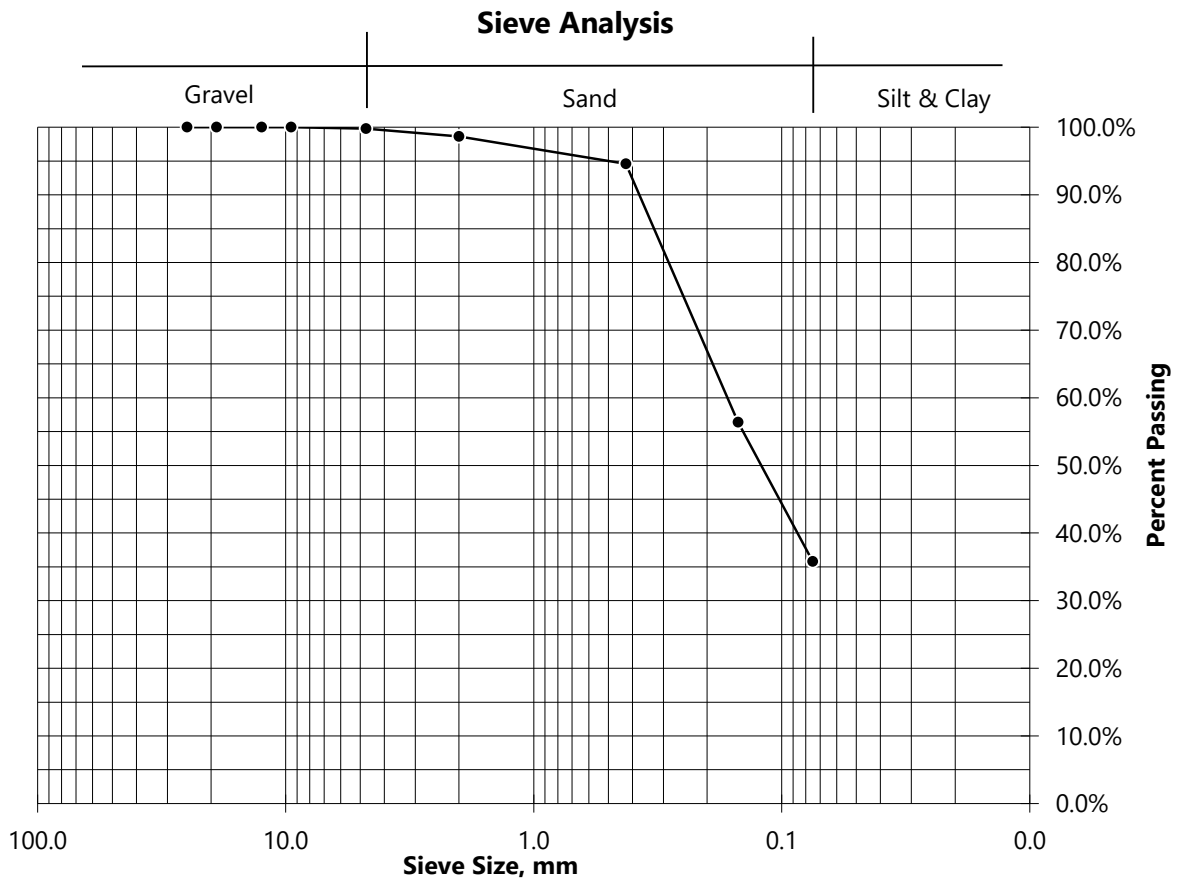
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Sample ID DAA-27

Sample Depth 14'-16'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.31	0.2%	4.75	99.8%
No. 10	1.64	1.2%	2.00	98.6%
No. 40	5.69	4.0%	0.425	94.6%
No. 100	53.68	38.2%	0.15	56.4%
No. 200	28.91	20.6%	0.075	35.8%
Pan	0.55	0.4%		
Total	90.78	64.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-27

Sample Depth 16'-18'

Visual Sample Description Light Gray Silty SAND

Sample Received: 4/11/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	20
Pan Wt	189.95 grams
Pan + Soil (wet)	373.46 grams
Pan + Soil (dry)	360.71 grams
Natural Moisture Content	7.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 316.54 grams

Percent Passing No. 200 Sieve 25.9%

Pan + Soil retained on No. 4 sieve

(dry) 191.06 grams

Percent Passing No. 4 Sieve 99.3%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-27

Sample Depth 16'-18'

Mechanical Sieve Analysis: ASTM D 422

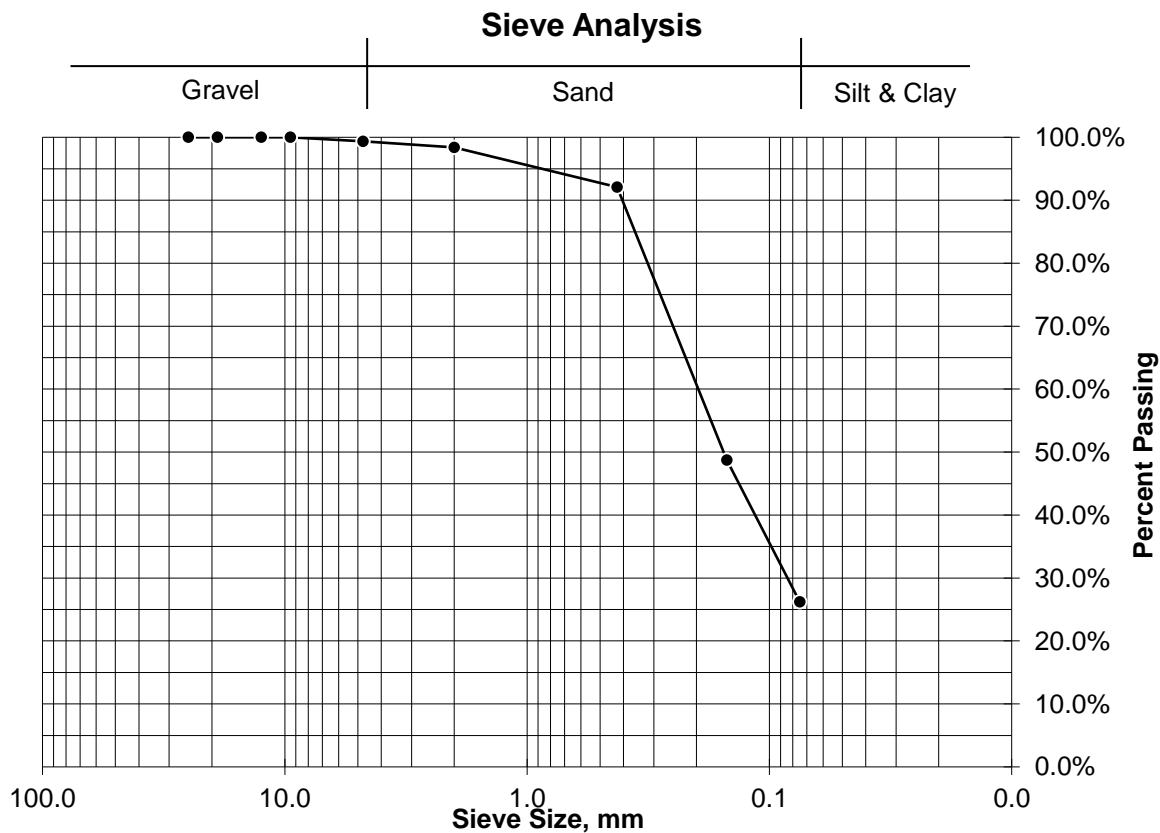


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	1.11	0.7%	4.75	99.3%
No. 10	1.66	1.0%	2.00	98.4%
No. 40	10.74	6.3%	0.425	92.1%
No. 100	74.06	43.4%	0.15	48.7%
No. 200	38.39	22.5%	0.075	26.2%
Pan	0.58	0.3%		
Total	126.54	74.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-28

Sample Depth 2'-4'

Visual Sample Description Dark Brown Clayey SAND

Sample Received: 4/11/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	105
Pan Wt	124.05 grams
Pan + Soil (wet)	248.62 grams
Pan + Soil (dry)	223.97 grams
Natural Moisture Content	24.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 181.28 grams

Percent Passing No. 200 Sieve 42.7%

Pan + Soil retained on No. 4 sieve

(dry) 124.05 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/25/2019

Liquid Limit

No of Blows	17	27	31
Pan ID	103	201	2000
Pan Wt	27.42	27.63	25.69
Pan + Soil (wet)	44.21	43.99	36.60
Pan + Soil (dry)	39.25	39.51	33.77
Moisture Content	41.9%	37.7%	35.1%
Liquid Limit	40	38	36
Liquid Limit	38		

Plastic Limit

Pan ID	315	354
Pan Weight	9.16	9.14
Pan + Soil (wet)	19.68	20.18
Pan + Soil (dry)	17.81	18.20
Moisture Content	21.6%	21.9%
Plastic Limit	22	
Plastic Index	16	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-28

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

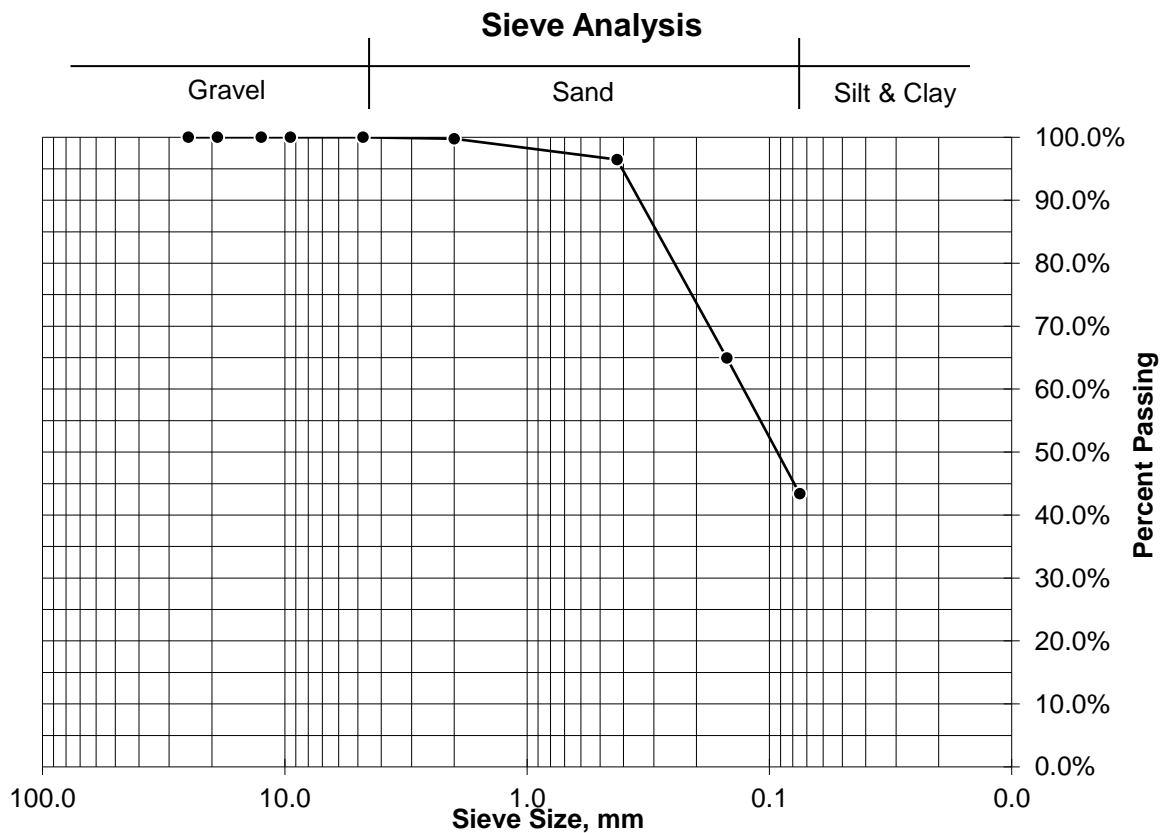


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.25	0.3%	2.00	99.7%
No. 40	3.30	3.3%	0.425	96.4%
No. 100	31.45	31.5%	0.15	65.0%
No. 200	21.57	21.6%	0.075	43.4%
Pan	0.65	0.7%		
Total	57.22	57.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-28

Sample Depth 4'-6'

Visual Sample Description Light Reddish-brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	110
Pan Wt	122.64 grams
Pan + Soil (wet)	248.23 grams
Pan + Soil (dry)	225.98 grams
Natural Moisture Content	21.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 191.50 grams

Percent Passing No. 200 Sieve 33.4%

Pan + Soil retained on No. 4 sieve

(dry) 122.64 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	17	23	35
Pan ID	98	103	109
Pan Wt	30.34	27.36	25.00
Pan + Soil (wet)	44.45	41.12	36.79
Pan + Soil (dry)	39.35	36.38	32.95
Moisture Content	56.6%	52.5%	48.3%
Liquid Limit	54	52	50
Liquid Limit	52		

Plastic Limit

Pan ID	78	315
Pan Weight	4.24	9.16
Pan + Soil (wet)	19.06	25.26
Pan + Soil (dry)	15.70	21.60
Moisture Content	29.3%	29.4%
Plastic Limit	29	
Plastic Index	23	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-28

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

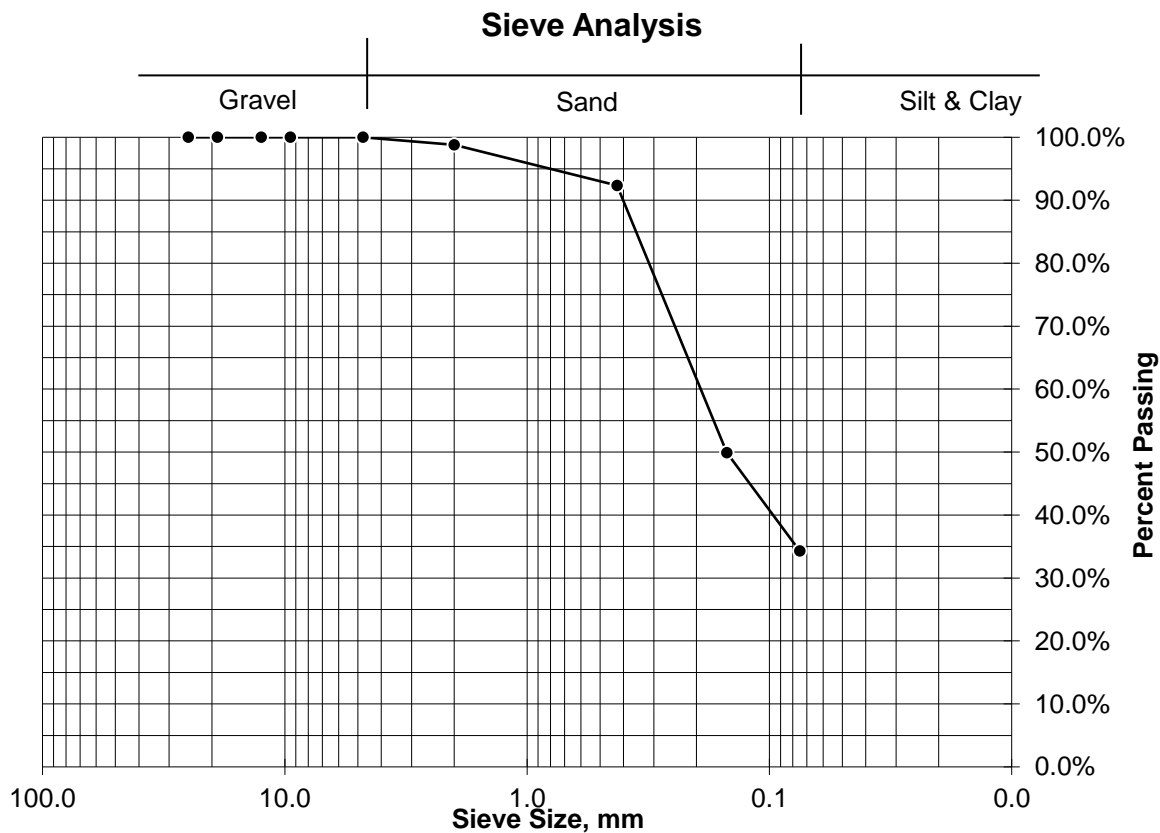


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.24	1.2%	2.00	98.8%
No. 40	6.69	6.5%	0.425	92.3%
No. 100	43.84	42.4%	0.15	49.9%
No. 200	16.12	15.6%	0.075	34.3%
Pan	0.93	0.9%		
Total	68.82	66.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-28

Sample Depth 10'-12'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	31
Pan Wt	192.97 grams
Pan + Soil (wet)	325.95 grams
Pan + Soil (dry)	307.47 grams
Natural Moisture Content	16.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 272.63 grams

Percent Passing No. 200 Sieve 30.4%

Pan + Soil retained on No. 4 sieve

(dry) 192.97 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/3/2019

Liquid Limit

No of Blows	20	25	34
Pan ID	92	103	109
Pan Wt	25.59	27.35	25.00
Pan + Soil (wet)	43.11	44.41	40.63
Pan + Soil (dry)	37.92	39.62	36.53
Moisture Content	42.1%	39.0%	35.5%
Liquid Limit	41	39	37
Liquid Limit	39		

Plastic Limit

Pan ID	352	356
Pan Weight	9.08	9.11
Pan + Soil (wet)	24.74	27.56
Pan + Soil (dry)	21.17	23.41
Moisture Content	29.5%	29.0%
Plastic Limit	29	
Plastic Index	10	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-28

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

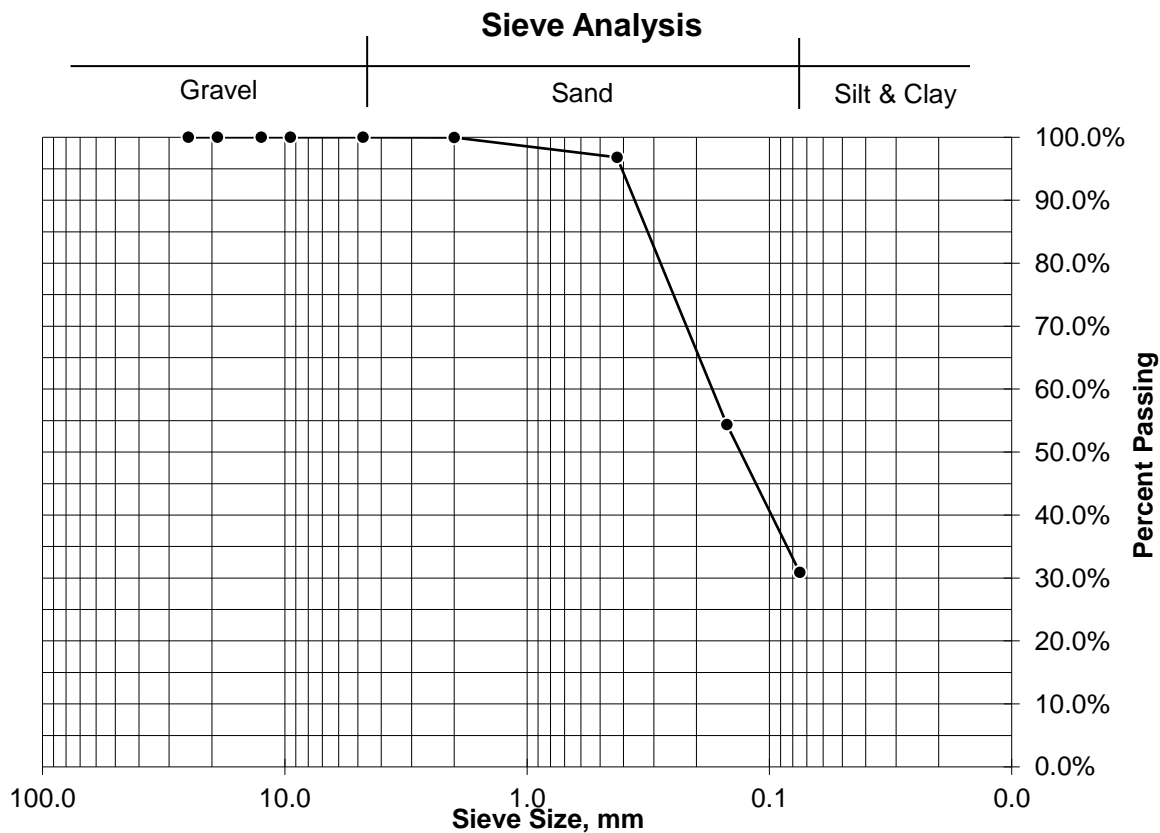


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.03	0.0%	2.00	100.0%
No. 40	3.62	3.2%	0.425	96.8%
No. 100	48.60	42.4%	0.15	54.4%
No. 200	26.85	23.4%	0.075	30.9%
Pan	0.52	0.5%		
Total	79.62	69.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-28

Sample Depth 28'-30'

Visual Sample Description Brownish-gray Silty SAND

Sample Received: 4/11/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	22
Pan Wt	188.96 grams
Pan + Soil (wet)	399.90 grams
Pan + Soil (dry)	382.04 grams
Natural Moisture Content	9.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 345.09 grams

Percent Passing No. 200 Sieve 19.1%

Pan + Soil retained on No. 4 sieve

(dry) 194.04 grams

Percent Passing No. 4 Sieve 97.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/22/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

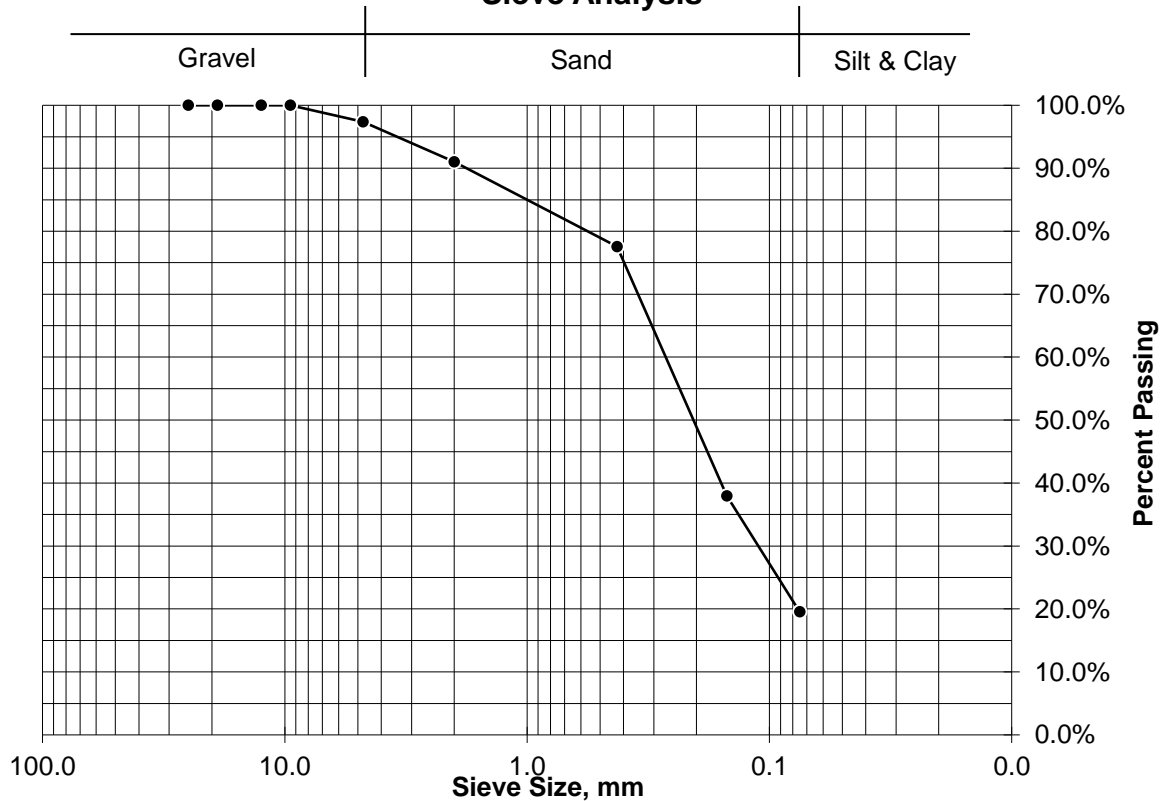
Sample ID DAA-28

Sample Depth 28'-30'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	5.08	2.6%	4.75	97.4%
No. 10	12.25	6.3%	2.00	91.0%
No. 40	26.00	13.5%	0.425	77.6%
No. 100	76.44	39.6%	0.15	38.0%
No. 200	35.58	18.4%	0.075	19.5%
Pan	0.77	0.4%		
Total	156.12	80.9%		

Sieve Analysis



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-28

Sample Depth 34'-36'

Visual Sample Description Brown Silty SAND

Sample Received: 4/11/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	24
Pan Wt	186.15 grams
Pan + Soil (wet)	314.37 grams
Pan + Soil (dry)	294.31 grams
Natural Moisture Content	18.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 270.42 grams

Percent Passing No. 200 Sieve 22.1%

Pan + Soil retained on No. 4 sieve

(dry) 186.15 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/24/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-28

Sample Depth 34'-36'

Mechanical Sieve Analysis: ASTM D 422

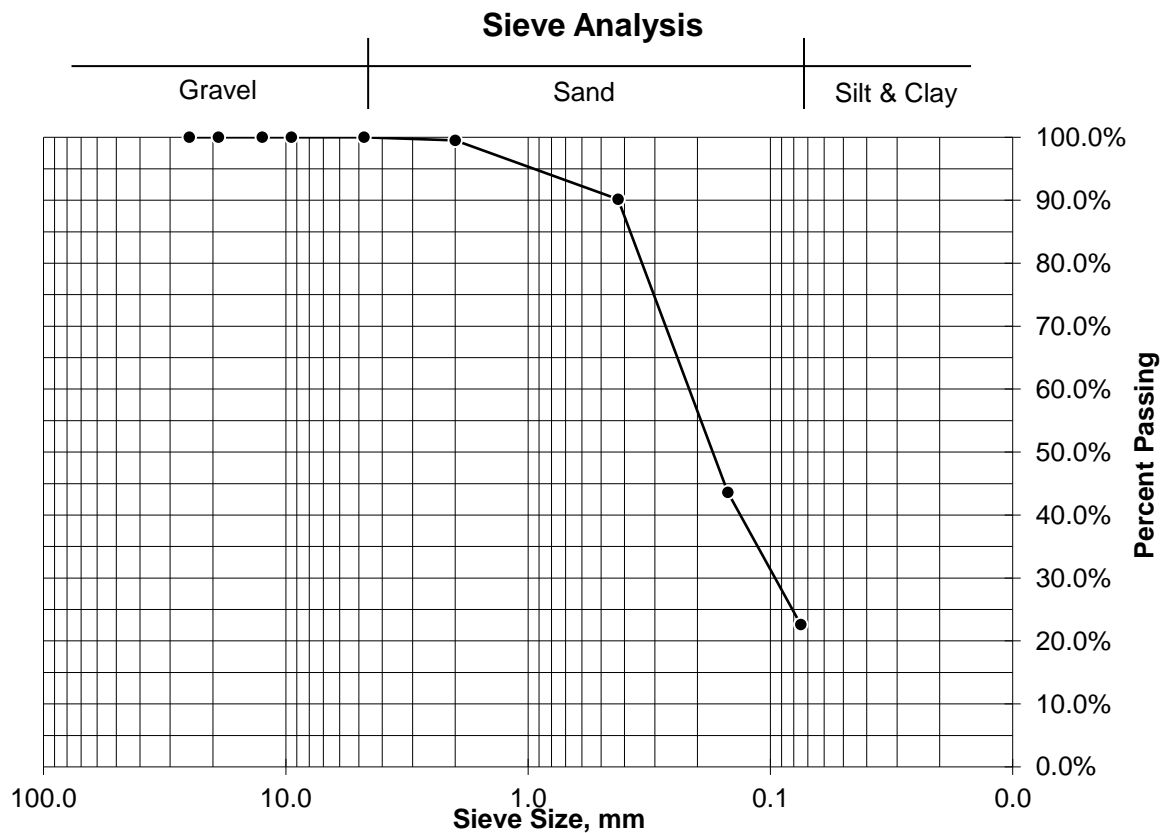


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.51	0.5%	2.00	99.5%
No. 40	10.16	9.4%	0.425	90.1%
No. 100	50.34	46.5%	0.15	43.6%
No. 200	22.68	21.0%	0.075	22.6%
Pan	0.56	0.5%		
Total	84.25	77.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-29

Sample Depth 2'-4'

Visual Sample Description Light Brown Clayey SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	21
Pan Wt	193.75 grams
Pan + Soil (wet)	328.60 grams
Pan + Soil (dry)	306.68 grams
Natural Moisture Content	19.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 274.10 grams

Percent Passing No. 200 Sieve 28.8%

Pan + Soil retained on No. 4 sieve

(dry) 194.04 grams

Percent Passing No. 4 Sieve 99.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows	18	27	32
Pan ID	93	62	96
Pan Wt	30.11	10.87	24.80
Pan + Soil (wet)	43.28	33.01	34.09
Pan + Soil (dry)	38.77	25.91	31.22
Moisture Content	52.0%	47.2%	44.6%
Liquid Limit	50	48	46
Liquid Limit	48		

Plastic Limit

Pan ID	315	314
Pan Weight	9.15	9.13
Pan + Soil (wet)	19.24	19.81
Pan + Soil (dry)	17.26	17.80
Moisture Content	24.4%	23.2%
Plastic Limit	24	
Plastic Index	24	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-29

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

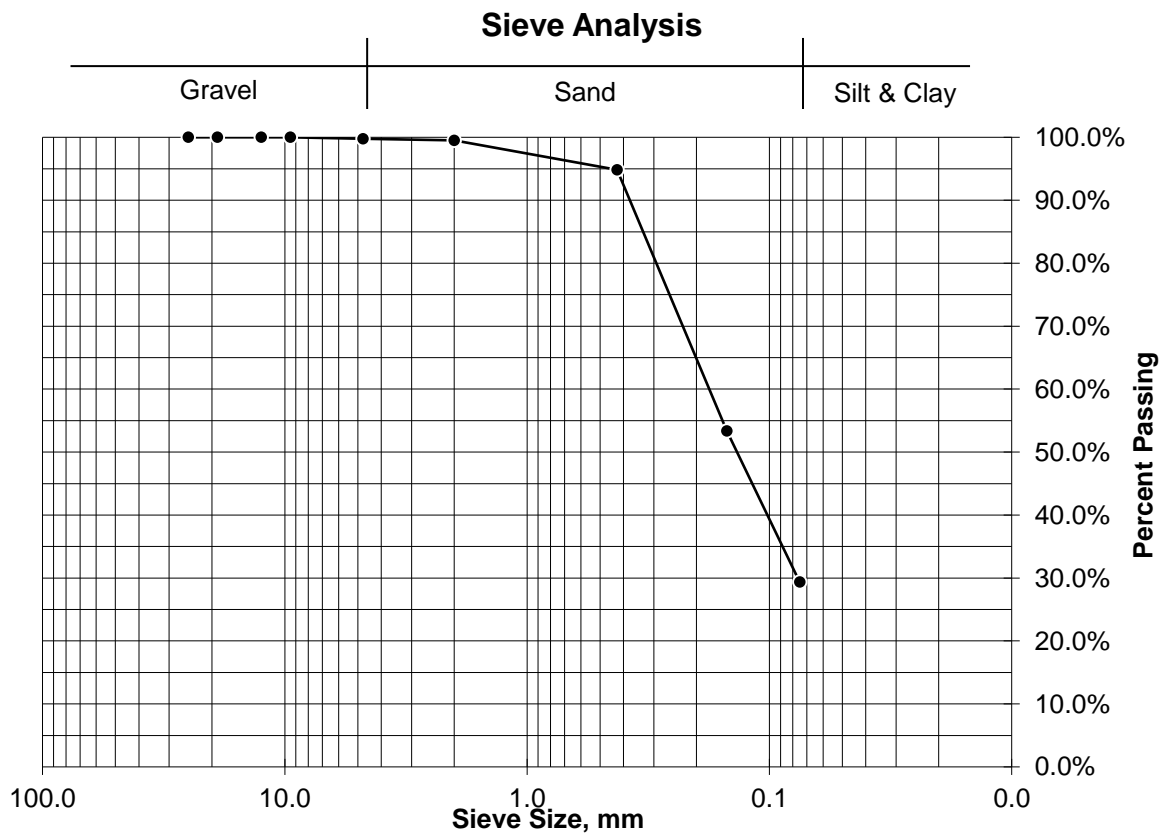


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Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.29	0.3%	4.75	99.7%
No. 10	0.25	0.2%	2.00	99.5%
No. 40	5.30	4.7%	0.425	94.8%
No. 100	46.80	41.4%	0.15	53.4%
No. 200	27.13	24.0%	0.075	29.4%
Pan	0.57	0.5%		
Total	80.34	71.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-29

Sample Depth 6'-8'

Visual Sample Description Brown Silty SAND with Gravel

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	41
Pan Wt	194.44 grams
Pan + Soil (wet)	318.66 grams
Pan + Soil (dry)	289.38 grams
Natural Moisture Content	30.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 267.58 grams

Percent Passing No. 200 Sieve 23.0%

Pan + Soil retained on No. 4 sieve

(dry) 220.35 grams

Percent Passing No. 4 Sieve 72.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows	18	26	32
Pan ID	701	704	708
Pan Wt	11.42	11.39	11.55
Pan + Soil (wet)	15.93	15.99	15.82
Pan + Soil (dry)	14.11	14.22	14.23
Moisture Content	67.6%	62.5%	59.2%
Liquid Limit	65	63	61
Liquid Limit	63		

Plastic Limit

Pan ID	58	359
Pan Weight	1.94	1.93
Pan + Soil (wet)	9.81	9.50
Pan + Soil (dry)	7.83	7.60
Moisture Content	33.6%	33.5%
Plastic Limit	34	
Plastic Index	29	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND with Gravel**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

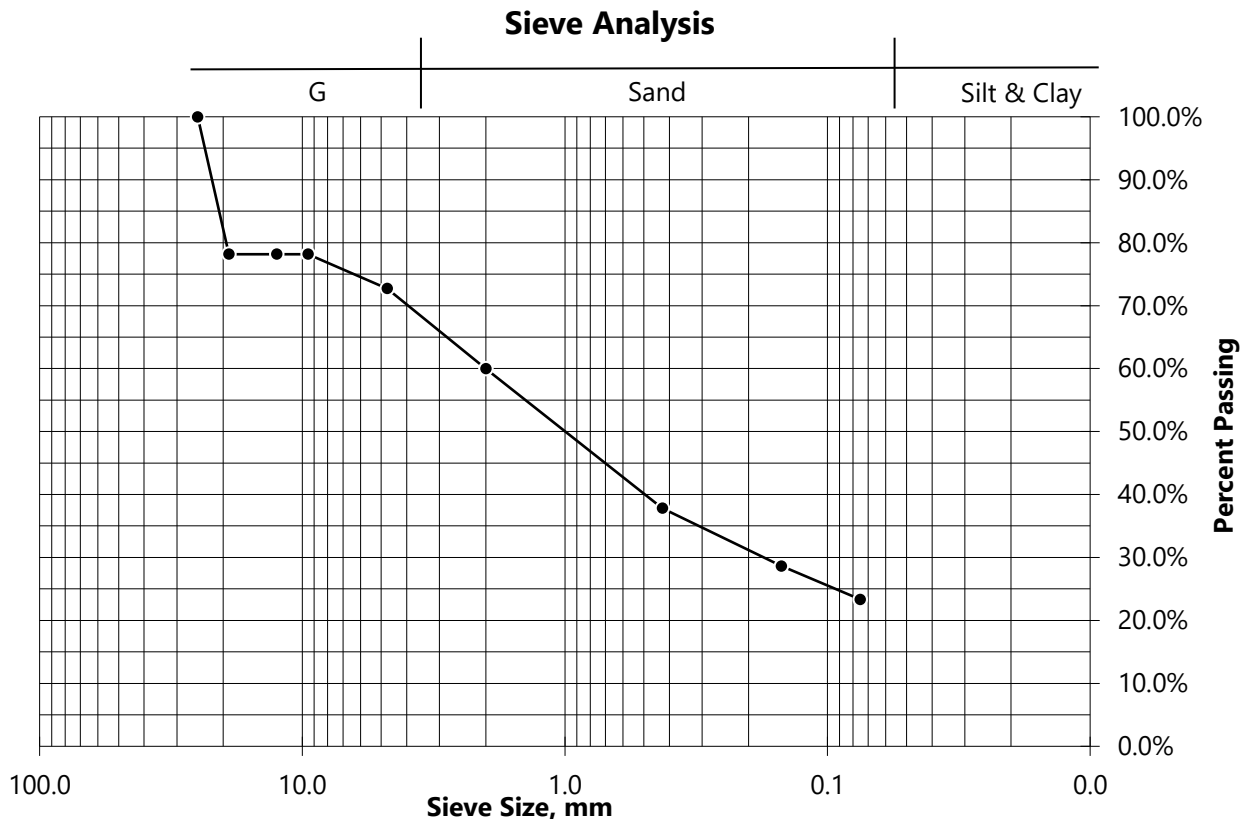
Prepared By: CBW

Sample ID DAA-29

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	20.71	21.8%	19.0	78.2%
1/2"	0.00	0.0%	12.5	78.2%
3/8"	0.00	0.0%	9.50	78.2%
No. 4	5.20	5.5%	4.75	72.7%
No. 10	12.08	12.7%	2.00	60.0%
No. 40	21.04	22.2%	0.425	37.8%
No. 100	8.71	9.2%	0.15	28.6%
No. 200	5.05	5.3%	0.075	23.3%
Pan	0.35	0.4%		
Total	73.14	77.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-29

Sample Depth 12'-14'

Visual Sample Description Brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	23
Pan Wt	193.98 grams
Pan + Soil (wet)	300.48 grams
Pan + Soil (dry)	271.97 grams
Natural Moisture Content	36.6%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 253.44 grams

Percent Passing No. 200 Sieve 23.8%

Pan + Soil retained on No. 4 sieve

(dry) 202.00 grams

Percent Passing No. 4 Sieve 89.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	18	26	32
Pan ID	98	103	109
Pan Wt	30.33	27.37	24.99
Pan + Soil (wet)	40.82	36.76	32.63
Pan + Soil (dry)	37.00	33.53	30.10
Moisture Content	57.2%	52.4%	49.5%
Liquid Limit	55	53	51
Liquid Limit	53		

Plastic Limit

Pan ID	313	314
Pan Weight	9.14	9.13
Pan + Soil (wet)	26.19	24.82
Pan + Soil (dry)	21.25	20.28
Moisture Content	40.8%	40.7%
Plastic Limit	41	
Plastic Index	12	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-29

Sample Depth 12'-14'

Mechanical Sieve Analysis: ASTM D 422



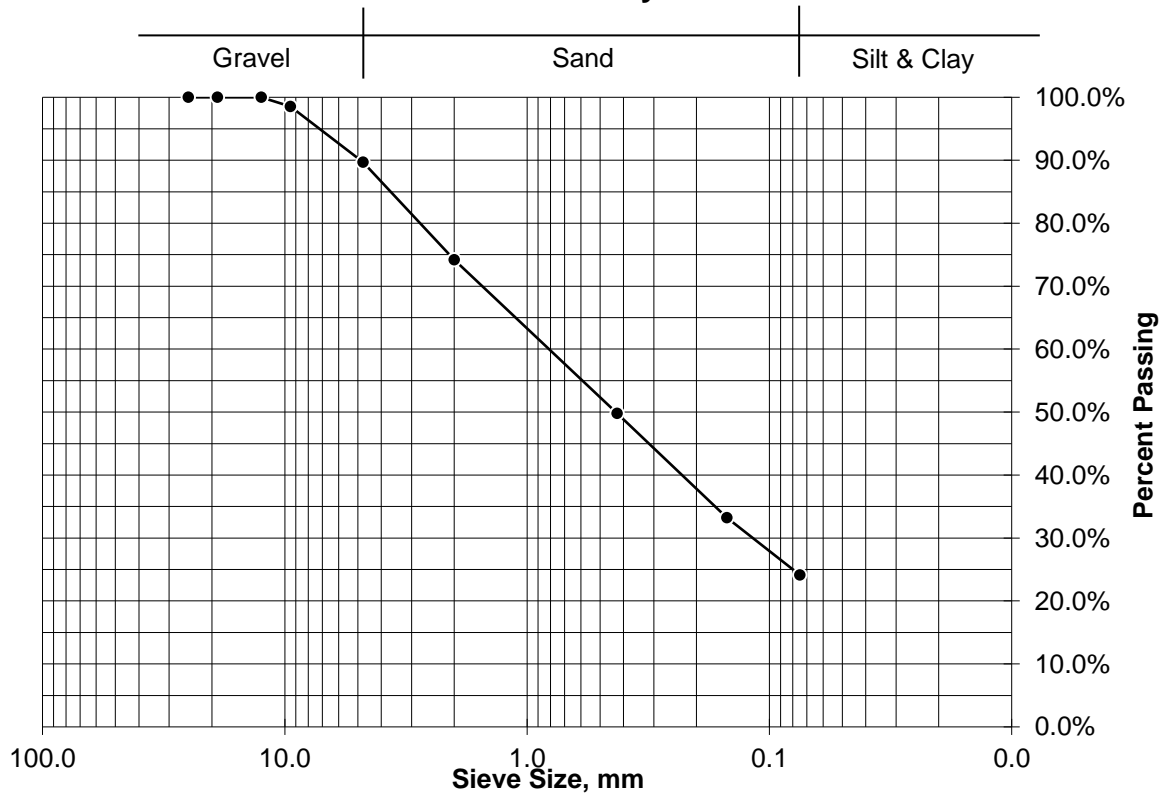
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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	1.12	1.4%	9.50	98.6%
No. 4	6.90	8.8%	4.75	89.7%
No. 10	12.09	15.5%	2.00	74.2%
No. 40	19.04	24.4%	0.425	49.8%
No. 100	12.93	16.6%	0.15	33.2%
No. 200	7.07	9.1%	0.075	24.2%
Pan	0.31	0.4%		
Total	59.46	76.2%		

Sieve Analysis



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-29

Sample Depth 24'-26'

Visual Sample Description Reddish-Brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	36
Pan Wt	193.75 grams
Pan + Soil (wet)	349.90 grams
Pan + Soil (dry)	313.89 grams
Natural Moisture Content	30.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 268.96 grams

Percent Passing No. 200 Sieve 37.4%

Pan + Soil retained on No. 4 sieve

(dry) 193.75 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/29/2019

Liquid Limit

No of Blows	17	26	32
Pan ID	70	72	65
Pan Wt	10.99	11.06	10.99
Pan + Soil (wet)	28.38	21.90	36.69
Pan + Soil (dry)	22.17	18.24	28.41
Moisture Content	55.5%	51.0%	47.6%
Liquid Limit	53	51	49
Liquid Limit	51		

Plastic Limit

Pan ID	18	73
Pan Weight	4.33	4.22
Pan + Soil (wet)	15.50	15.86
Pan + Soil (dry)	12.60	12.83
Moisture Content	35.1%	35.2%
Plastic Limit	35	
Plastic Index	16	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

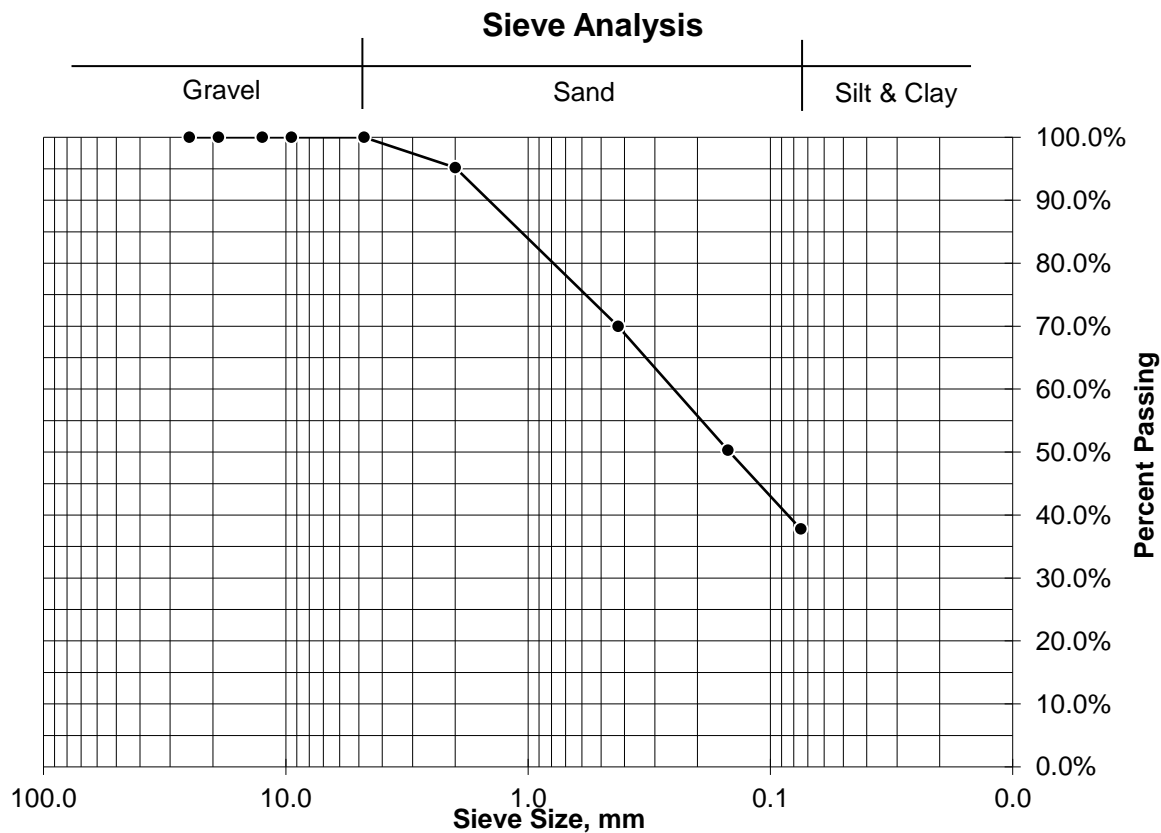
Prepared By: CBW

Sample ID DAA-29

Sample Depth 24'-26'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	5.78	4.8%	2.00	95.2%
No. 40	30.30	25.2%	0.425	70.0%
No. 100	23.64	19.7%	0.15	50.3%
No. 200	15.02	12.5%	0.075	37.8%
Pan	0.47	0.4%		
Total	75.21	62.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-33

Sample Depth 2'-4'

Visual Sample Description Red Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	8
Pan Wt	187.15 grams
Pan + Soil (wet)	335.23 grams
Pan + Soil (dry)	303.13 grams
Natural Moisture Content	27.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	261.34 grams
Percent Passing No. 200 Sieve	36.0%
Pan + Soil retained on No. 4 sieve	
(dry)	187.15 grams
Percent Passing No. 4 Sieve	100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows	17	26	32
Pan ID	2	314	703
Pan Wt	9.02	9.12	11.53
Pan + Soil (wet)	19.41	20.30	21.05
Pan + Soil (dry)	15.16	15.96	17.46
Moisture Content	69.2%	63.5%	60.5%
Liquid Limit	66	64	62
Liquid Limit	64		

Plastic Limit

Pan ID	23	73
Pan Weight	4.32	4.23
Pan + Soil (wet)	15.69	14.27
Pan + Soil (dry)	12.56	11.51
Moisture Content	38.0%	37.9%
Plastic Limit	38	
Plastic Index	26	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

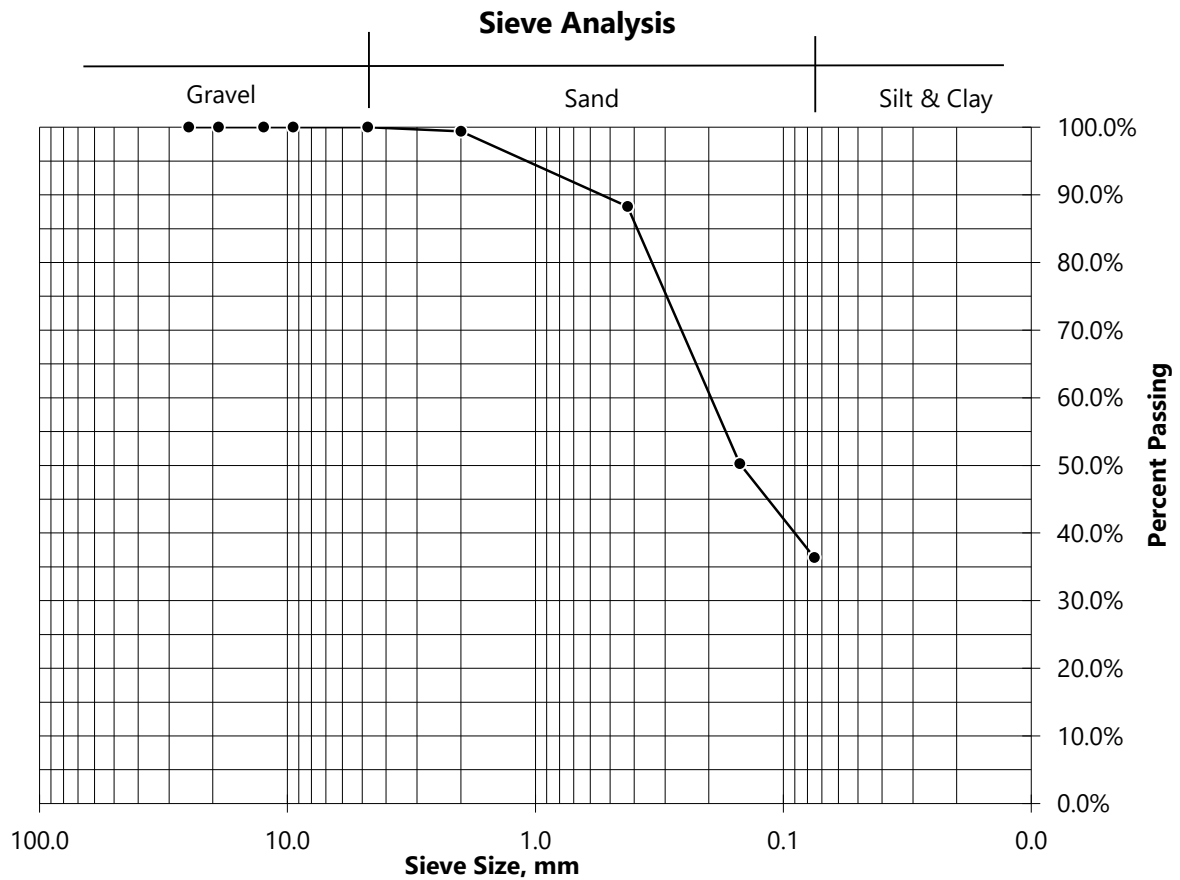
Prepared By: CBW

Sample ID DAA-33

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.73	0.6%	2.00	99.4%
No. 40	12.90	11.1%	0.425	88.2%
No. 100	44.08	38.0%	0.15	50.2%
No. 200	16.09	13.9%	0.075	36.4%
Pan	0.33	0.3%		
Total	74.13	63.9%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-33

Sample Depth 4'-6'

Visual Sample Description Light Reddish-brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	38
Pan Wt	193.65 grams
Pan + Soil (wet)	300.60 grams
Pan + Soil (dry)	277.67 grams
Natural Moisture Content	27.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	253.13 grams
Percent Passing No. 200 Sieve	29.2%
Pan + Soil retained on No. 4 sieve	
(dry)	193.65 grams
Percent Passing No. 4 Sieve	100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows	19	23	35
Pan ID	91	169	201
Pan Wt	24.49	27.13	27.63
Pan + Soil (wet)	34.09	36.18	36.99
Pan + Soil (dry)	30.35	32.78	33.64
Moisture Content	63.8%	60.2%	55.7%
Liquid Limit	62	60	58
Liquid Limit	60		

Plastic Limit

Pan ID	354	356
Pan Weight	9.13	9.08
Pan + Soil (wet)	24.29	24.75
Pan + Soil (dry)	20.53	20.85
Moisture Content	33.0%	33.1%
Plastic Limit	33	
Plastic Index	27	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

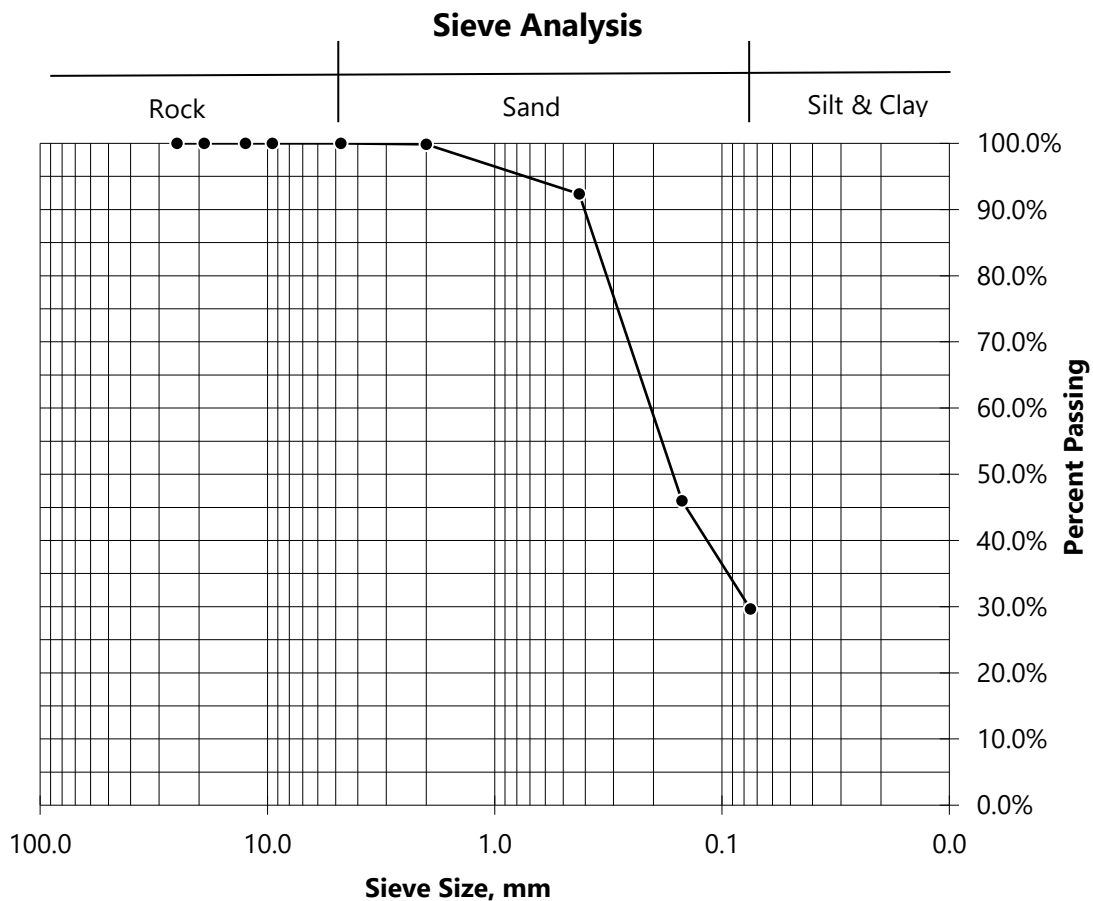
Prepared By: CBW

Sample ID DAA-33

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.14	0.2%	2.00	99.8%
No. 40	6.28	7.5%	0.425	92.4%
No. 100	38.97	46.4%	0.15	46.0%
No. 200	13.72	16.3%	0.075	29.6%
Pan	0.32	0.4%		
Total	59.43	70.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-33

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	19
Pan Wt	188.54 grams
Pan + Soil (wet)	363.97 grams
Pan + Soil (dry)	332.50 grams
Natural Moisture Content	21.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve	
(dry)	303.48 grams
Percent Passing No. 200 Sieve	20.2%
Pan + Soil retained on No. 4 sieve	
(dry)	190.18 grams
Percent Passing No. 4 Sieve	98.9%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/23/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			

Liquid Limit

Liquid Limit

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		

Plastic Limit

Plastic Index

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

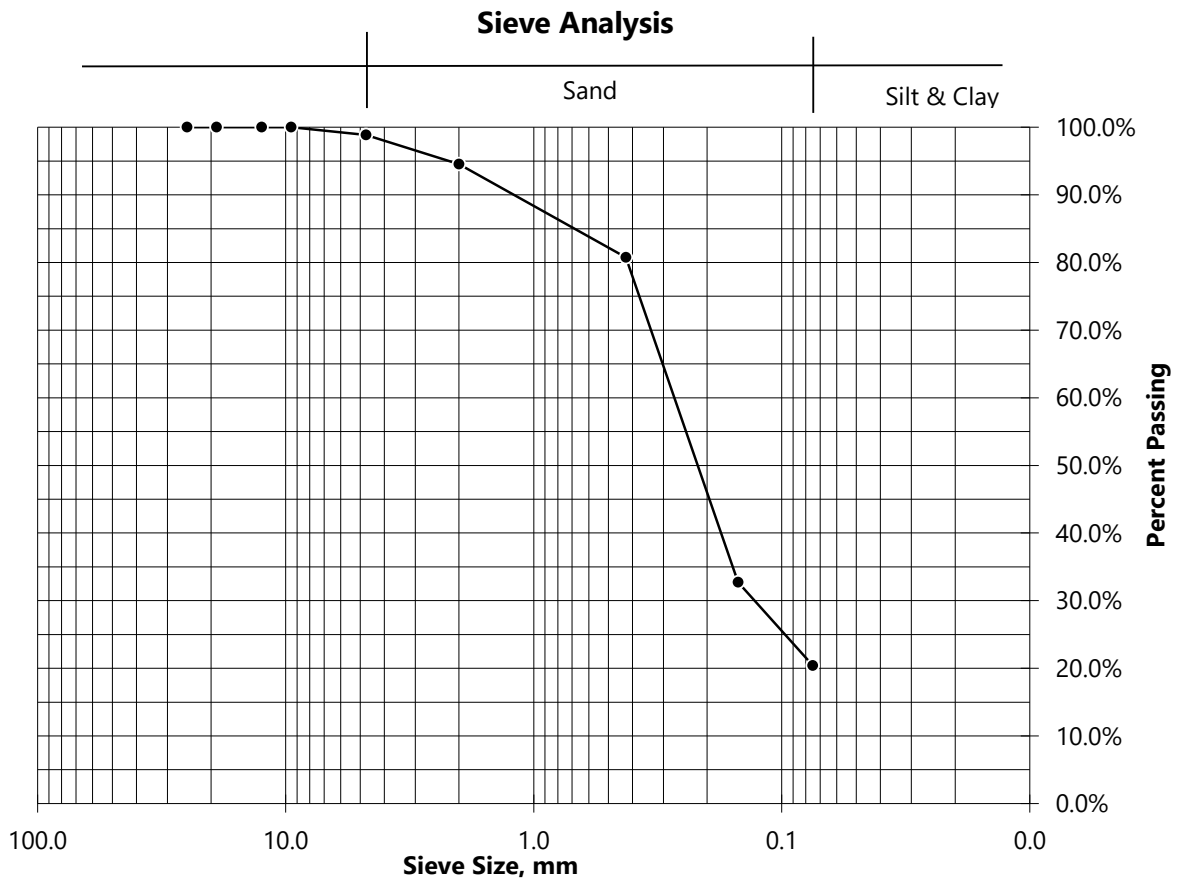
Prepared By: CBW

Sample ID DAA-33

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	1.64	1.1%	4.75	98.9%
No. 10	6.24	4.3%	2.00	94.5%
No. 40	19.85	13.8%	0.425	80.7%
No. 100	69.12	48.0%	0.15	32.7%
No. 200	17.71	12.3%	0.075	20.4%
Pan	0.36	0.3%		
Total	114.92	79.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-33

Sample Depth 8'-10'

Visual Sample Description Light Gray Clayey SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	6
Pan Wt	195.34 grams
Pan + Soil (wet)	307.15 grams
Pan + Soil (dry)	294.30 grams
Natural Moisture Content	13.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 253.78 grams

Percent Passing No. 200 Sieve 40.9%

Pan + Soil retained on No. 4 sieve

(dry) 198.00 grams

Percent Passing No. 4 Sieve 97.3%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	15	23	35
Pan ID	101	107	108
Pan Wt	23.99	25.11	33.14
Pan + Soil (wet)	39.02	37.64	44.89
Pan + Soil (dry)	35.03	34.57	42.26
Moisture Content	36.2%	32.5%	28.8%
Liquid Limit	34	32	30
Liquid Limit	32		

Plastic Limit

Pan ID	315	352
Pan Weight	9.15	9.07
Pan + Soil (wet)	31.65	29.36
Pan + Soil (dry)	27.76	25.84
Moisture Content	20.9%	21.0%
Plastic Limit	21	
Plastic Index	11	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

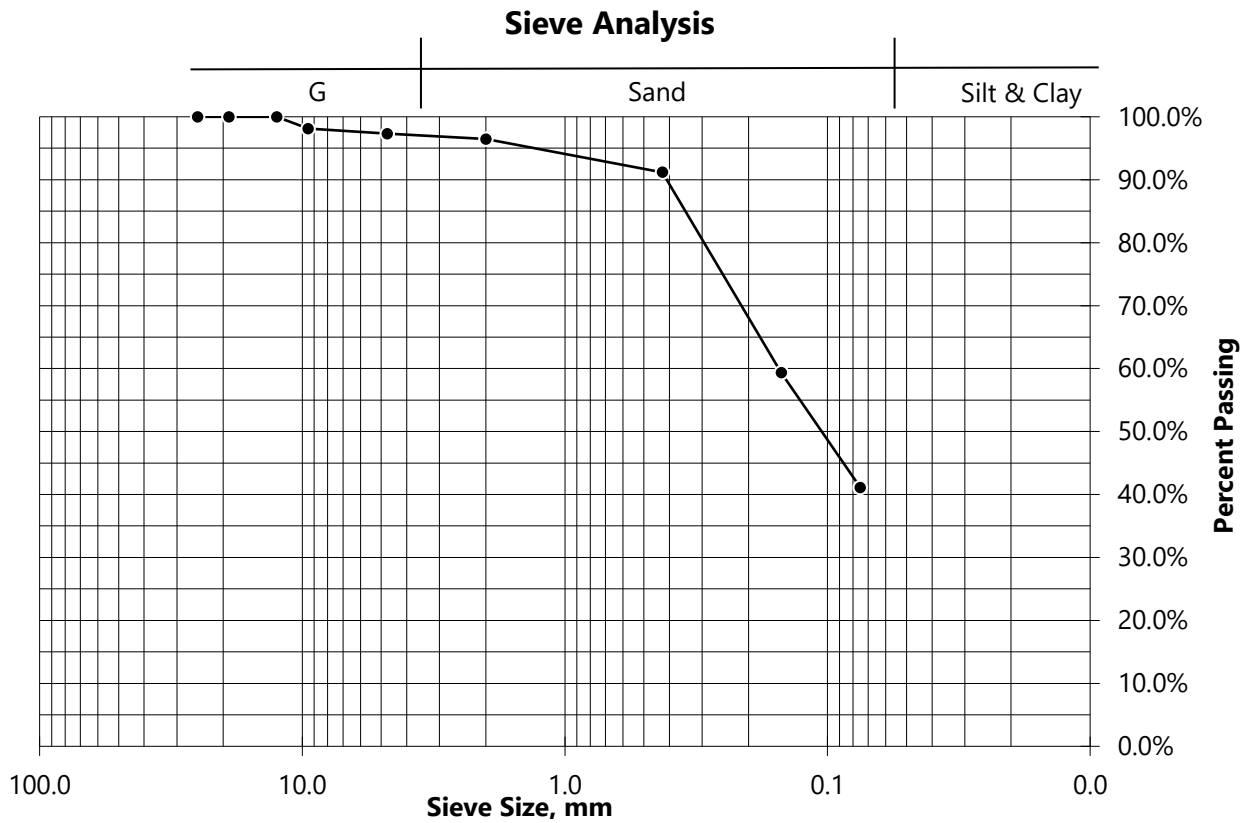
Prepared By: CBW

Sample ID DAA-33

Sample Depth 8'-10'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	1.85	1.9%	9.50	98.1%
No. 4	0.81	0.8%	4.75	97.3%
No. 10	0.85	0.9%	2.00	96.5%
No. 40	5.22	5.3%	0.425	91.2%
No. 100	31.50	31.8%	0.15	59.3%
No. 200	18.04	18.2%	0.075	41.1%
Pan	0.17	0.2%		
Total	58.44	59.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-33

Sample Depth 10'-12'

Visual Sample Description Light Gray Clayey SAND

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	7
Pan Wt	192.34 grams
Pan + Soil (wet)	333.57 grams
Pan + Soil (dry)	317.63 grams
Natural Moisture Content	12.7%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 277.96 grams

Percent Passing No. 200 Sieve 31.7%

Pan + Soil retained on No. 4 sieve

(dry) 203.21 grams

Percent Passing No. 4 Sieve 91.3%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	16	26	31
Pan ID	91	96	102
Pan Wt	24.50	24.82	23.96
Pan + Soil (wet)	34.07	34.41	36.18
Pan + Soil (dry)	31.39	31.93	33.21
Moisture Content	38.9%	34.8%	32.2%
Liquid Limit	37	35	33
Liquid Limit	35		

Plastic Limit

Pan ID	19	74
Pan Weight	4.35	4.24
Pan + Soil (wet)	17.26	17.16
Pan + Soil (dry)	15.32	15.22
Moisture Content	17.7%	17.7%
Plastic Limit	18	
Plastic Index	17	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

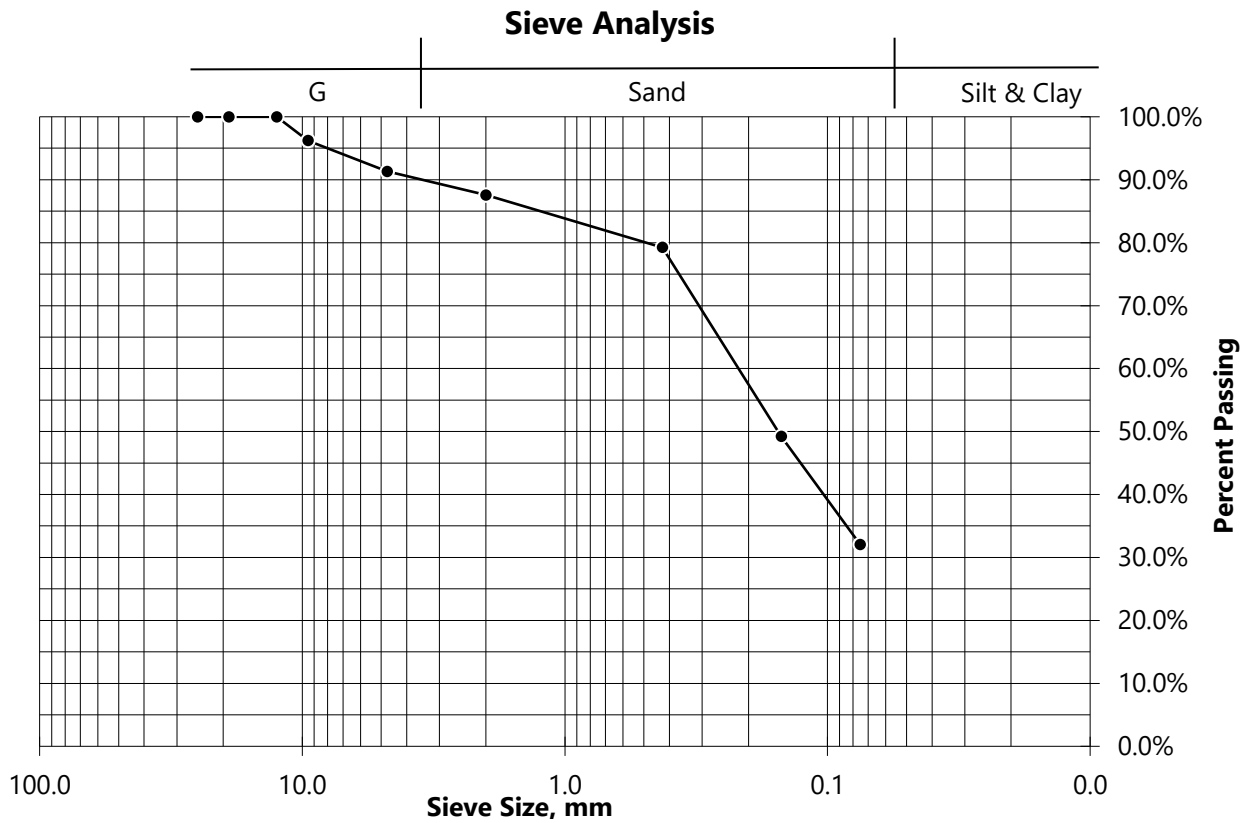
Prepared By: CBW

Sample ID DAA-33

Sample Depth 10'-12'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	4.75	3.8%	9.50	96.2%
No. 4	6.12	4.9%	4.75	91.3%
No. 10	4.69	3.7%	2.00	87.6%
No. 40	10.44	8.3%	0.425	79.2%
No. 100	37.63	30.0%	0.15	49.2%
No. 200	21.53	17.2%	0.075	32.0%
Pan	0.46	0.4%		
Total	85.62	68.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-33

Sample Depth 12'-14'

Visual Sample Description Light Reddish-brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	22
Pan Wt	189.01 grams
Pan + Soil (wet)	336.96 grams
Pan + Soil (dry)	325.31 grams
Natural Moisture Content	8.5%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 297.36 grams

Percent Passing No. 200 Sieve 20.5%

Pan + Soil retained on No. 4 sieve

(dry) 189.22 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/17/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

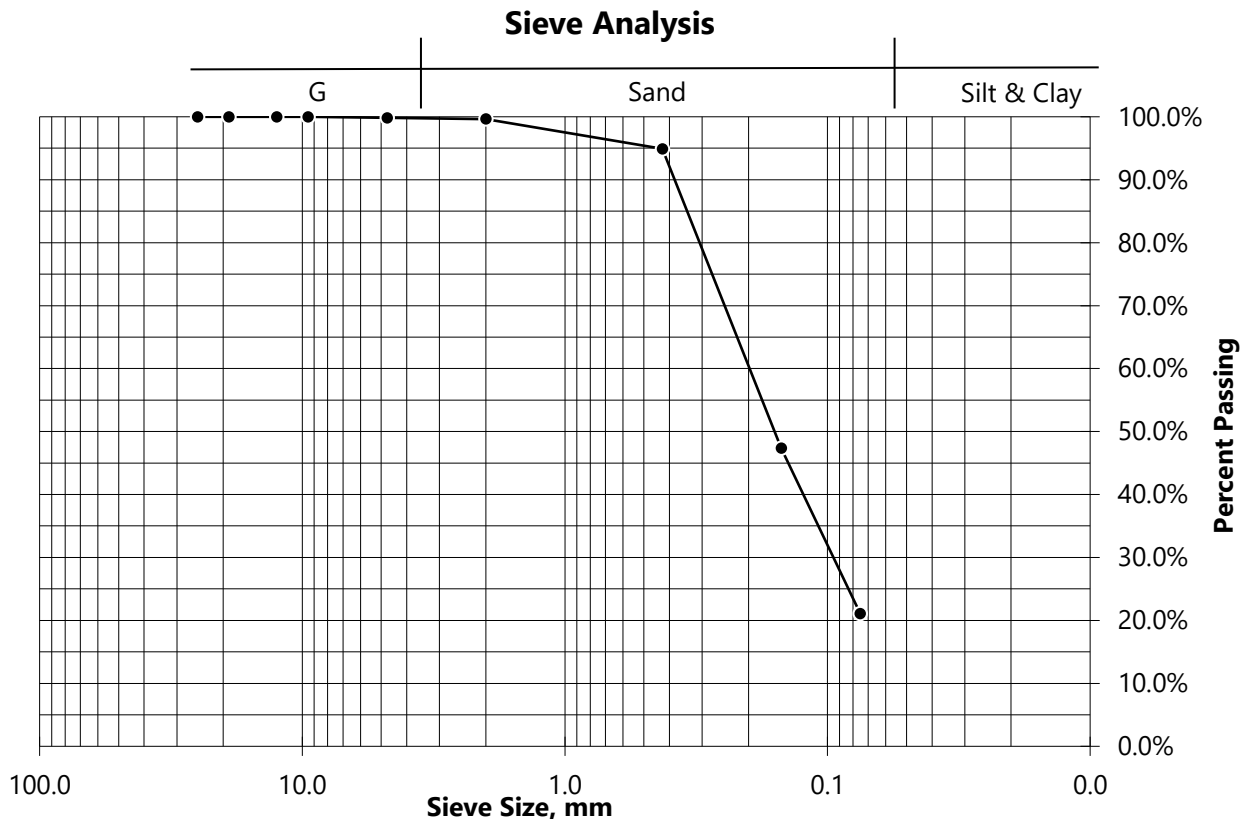
Prepared By: CBW

Sample ID DAA-33

Sample Depth 12'-14'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.21	0.2%	4.75	99.8%
No. 10	0.29	0.2%	2.00	99.6%
No. 40	6.46	4.7%	0.425	94.9%
No. 100	64.82	47.6%	0.15	47.3%
No. 200	35.81	26.3%	0.075	21.1%
Pan	0.74	0.5%		
Total	108.33	79.5%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-34

Sample Depth 2'-4'

Visual Sample Description Reddish-brown Clayey SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	25
Pan Wt	194.03 grams
Pan + Soil (wet)	297.16 grams
Pan + Soil (dry)	275.38 grams
Natural Moisture Content	26.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 235.52 grams

Percent Passing No. 200 Sieve 49.0%

Pan + Soil retained on No. 4 sieve

(dry) 194.03 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/21/2019

Liquid Limit

No of Blows	19	25	33
Pan ID	61	65	6
Pan Wt	10.89	10.94	11.19
Pan + Soil (wet)	21.21	22.31	21.59
Pan + Soil (dry)	16.99	17.84	17.65
Moisture Content	69.3%	64.8%	60.9%
Liquid Limit	67	65	63
Liquid Limit	65		

Plastic Limit

Pan ID	82	74
Pan Weight	4.23	4.25
Pan + Soil (wet)	14.30	14.52
Pan + Soil (dry)	12.65	12.83
Moisture Content	19.6%	19.7%
Plastic Limit	20	
Plastic Index	45	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

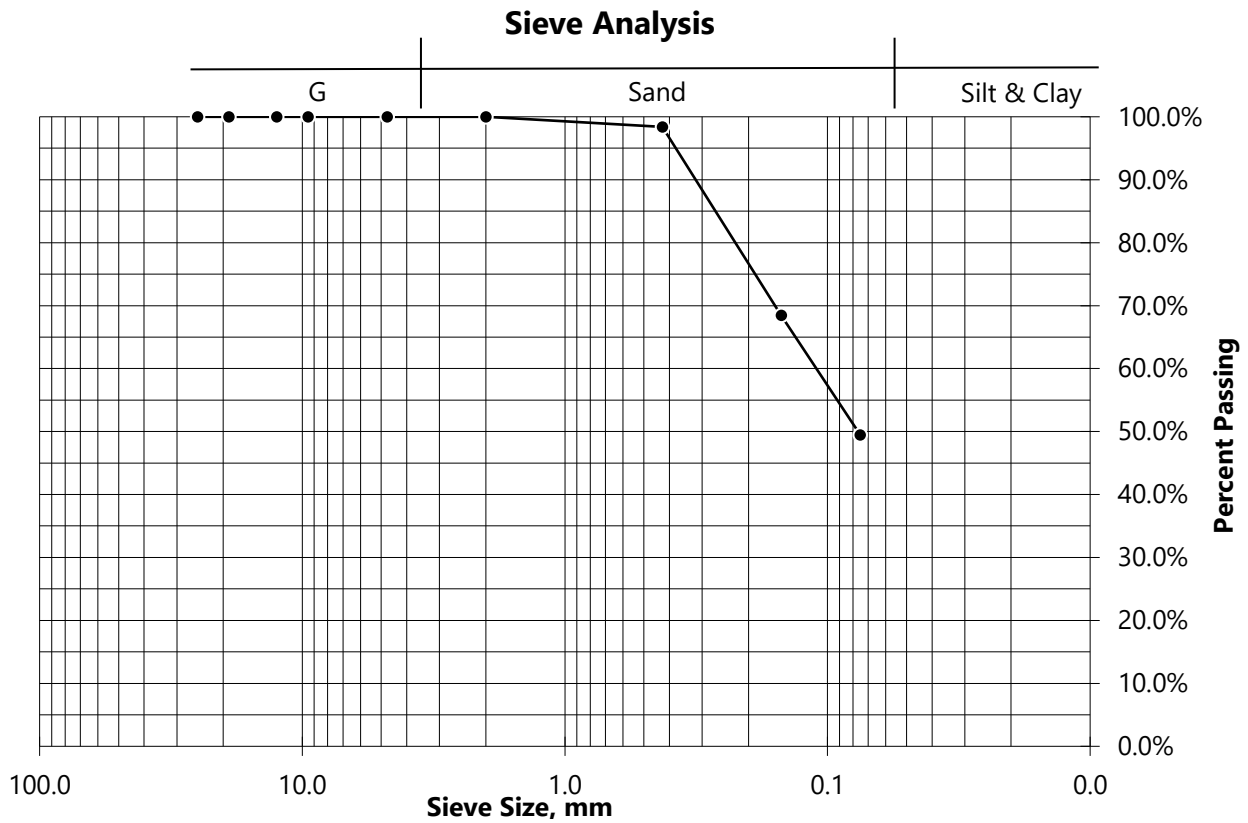
Prepared By: CBW

Sample ID DAA-34

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.00	0.0%	2.00	100.0%
No. 40	1.31	1.6%	0.425	98.4%
No. 100	24.37	30.0%	0.15	68.4%
No. 200	15.43	19.0%	0.075	49.5%
Pan	0.37	0.5%		
Total	41.48	51.0%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-34

Sample Depth 6'-8'

Visual Sample Description Light Brown Clayey SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	39
Pan Wt	193.09 grams
Pan + Soil (wet)	295.84 grams
Pan + Soil (dry)	286.39 grams
Natural Moisture Content	10.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 270.19 grams

Percent Passing No. 200 Sieve 17.4%

Pan + Soil retained on No. 4 sieve

(dry) 193.34 grams

Percent Passing No. 4 Sieve 99.7%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows	19	24	34
Pan ID	705	710	711
Pan Wt	11.53	11.49	11.55
Pan + Soil (wet)	16.80	16.03	16.39
Pan + Soil (dry)	15.34	14.85	15.22
Moisture Content	38.2%	35.1%	31.8%
Liquid Limit	37	35	33
Liquid Limit	35		

Plastic Limit

Pan ID	26	122
Pan Weight	2.41	2.42
Pan + Soil (wet)	9.25	11.34
Pan + Soil (dry)	8.15	9.90
Moisture Content	19.2%	19.3%
Plastic Limit	19	
Plastic Index	16	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

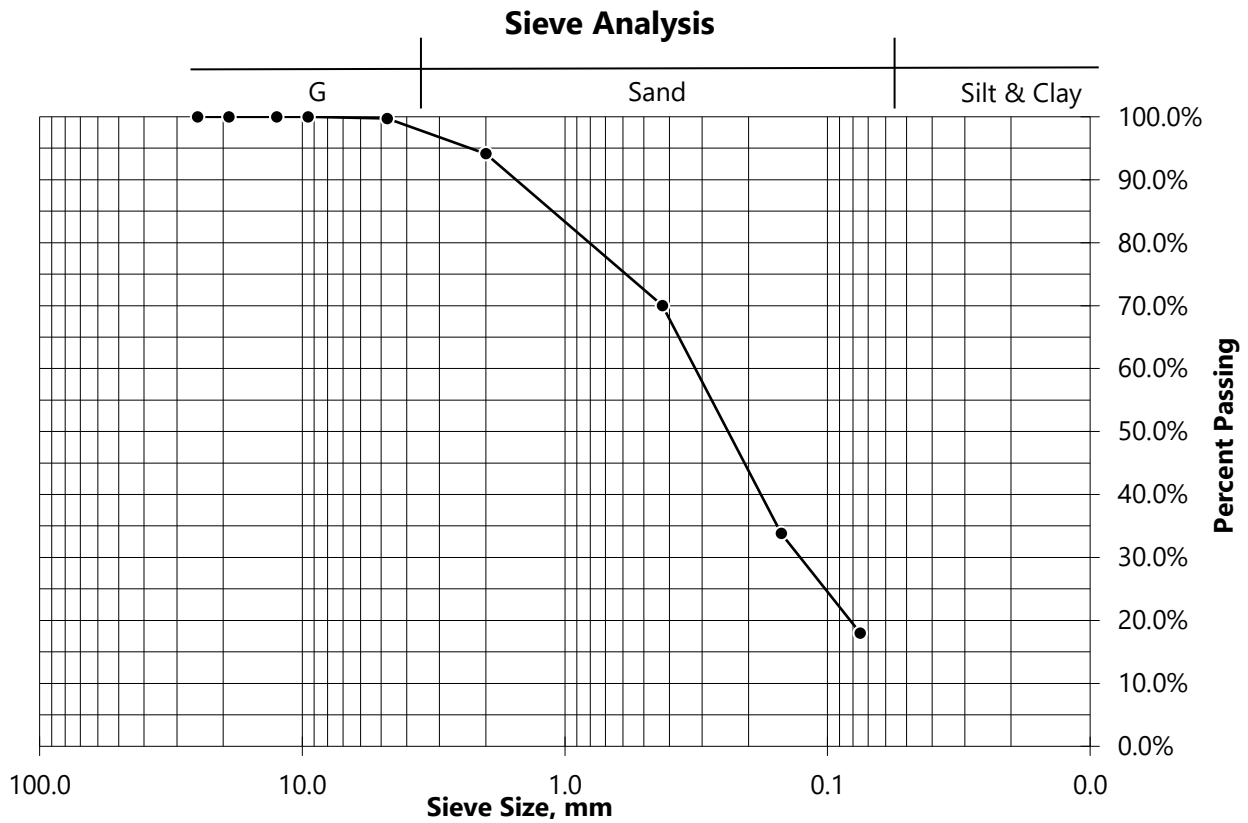
Prepared By: CBW

Sample ID DAA-34

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.25	0.3%	4.75	99.7%
No. 10	5.23	5.6%	2.00	94.1%
No. 40	22.50	24.1%	0.425	70.0%
No. 100	33.77	36.2%	0.15	33.8%
No. 200	14.78	15.8%	0.075	18.0%
Pan	0.54	0.6%		
Total	77.07	82.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-33

Sample Depth 20'-22'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	4
Pan Wt	194.52 grams
Pan + Soil (wet)	307.70 grams
Pan + Soil (dry)	289.46 grams
Natural Moisture Content	19.2%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 262.04 grams

Percent Passing No. 200 Sieve 28.9%

Pan + Soil retained on No. 4 sieve

(dry) 194.52 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/29/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

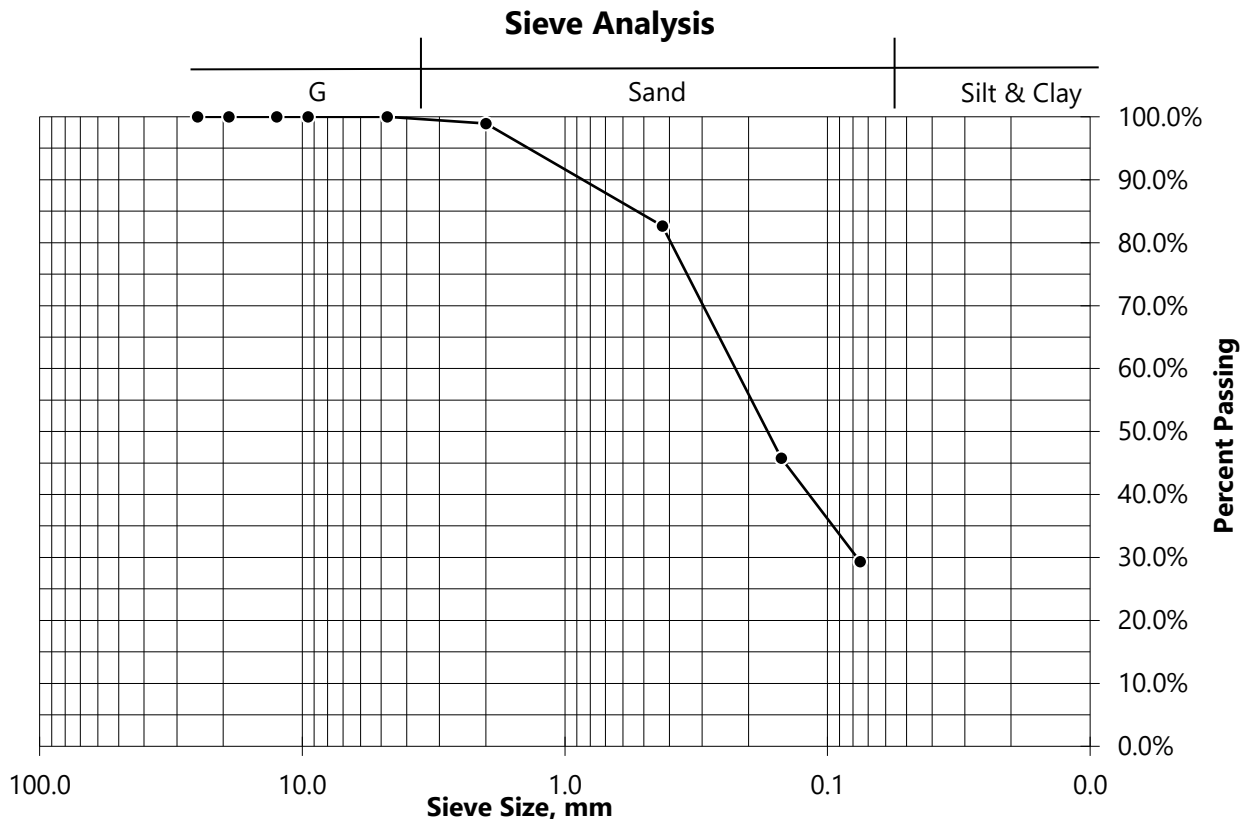
Prepared By: CBW

Sample ID DAA-33

Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.01	1.1%	2.00	98.9%
No. 40	15.46	16.3%	0.425	82.7%
No. 100	35.01	36.9%	0.15	45.8%
No. 200	15.64	16.5%	0.075	29.3%
Pan	0.40	0.4%		
Total	67.52	71.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-35

Sample Depth 2'-4'

Visual Sample Description Red Sandy Lean CLAY

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	10
Pan Wt	184.07 grams
Pan + Soil (wet)	299.66 grams
Pan + Soil (dry)	279.65 grams
Natural Moisture Content	20.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 224.48 grams

Percent Passing No. 200 Sieve 57.7%

Pan + Soil retained on No. 4 sieve

(dry) 184.07 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	16	27	35
Pan ID	108	169	201
Pan Wt	33.14	27.12	27.64
Pan + Soil (wet)	43.65	40.63	40.98
Pan + Soil (dry)	40.12	36.39	37.02
Moisture Content	50.6%	45.7%	42.2%
Liquid Limit	48	46	44
Liquid Limit	46		

Plastic Limit

Pan ID	313	352
Pan Weight	9.14	9.09
Pan + Soil (wet)	25.41	21.57
Pan + Soil (dry)	22.33	19.26
Moisture Content	23.4%	22.7%
Plastic Limit	23	
Plastic Index	23	

USCS Classification: ASTM D 2487

Group Symbol **CL**

Group Name **Sandy Lean CLAY**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

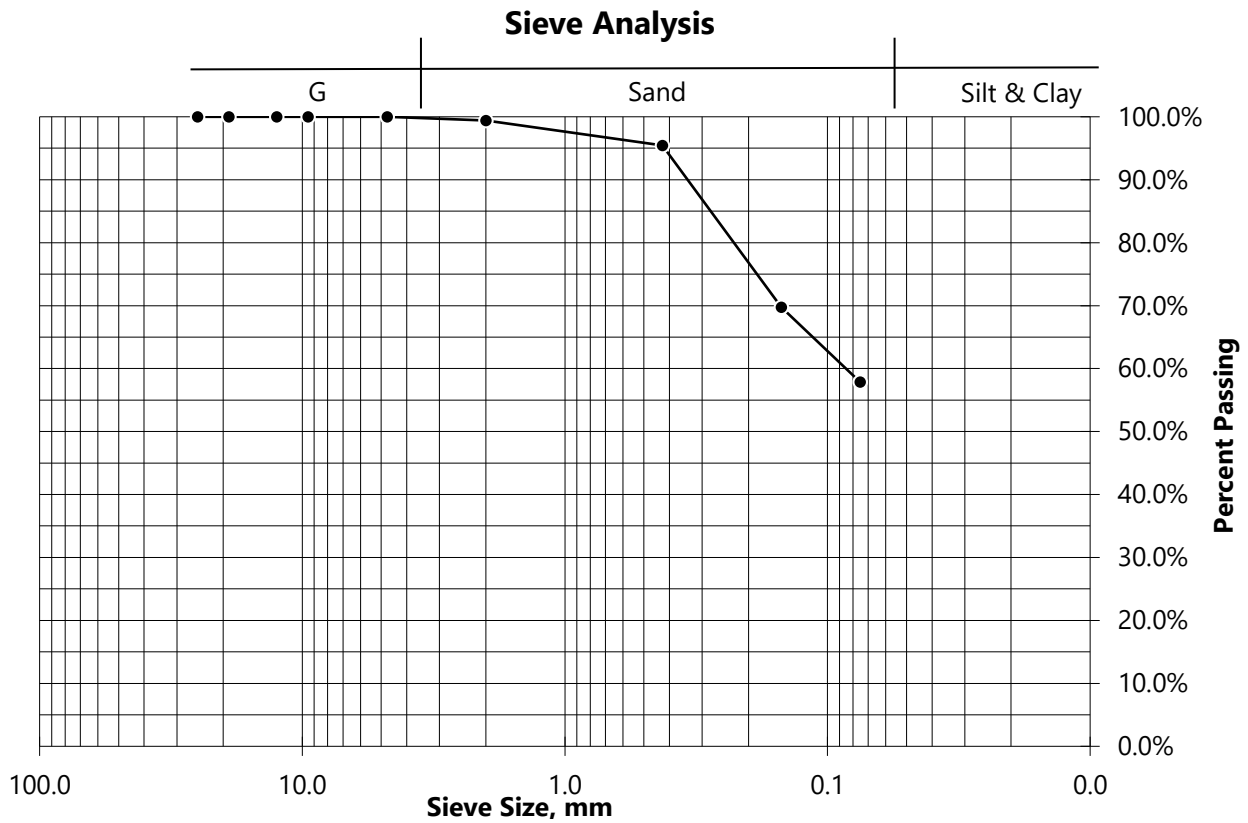
Prepared By: CBW

Sample ID DAA-35

Sample Depth 2'-4'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.58	0.6%	2.00	99.4%
No. 40	3.78	4.0%	0.425	95.4%
No. 100	24.54	25.7%	0.15	69.8%
No. 200	11.40	11.9%	0.075	57.8%
Pan	0.10	0.1%		
Total	40.40	42.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-35

Sample Depth 4'-6'

Visual Sample Description Red Clayey SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	17
Pan Wt	188.69 grams
Pan + Soil (wet)	313.98 grams
Pan + Soil (dry)	278.70 grams
Natural Moisture Content	39.2%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 241.47 grams

Percent Passing No. 200 Sieve 41.4%

Pan + Soil retained on No. 4 sieve

(dry) 189.64 grams

Percent Passing No. 4 Sieve 98.9%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/20/2019

Liquid Limit

No of Blows	16	22	34
Pan ID	6	10	69
Pan Wt	11.21	11.24	10.96
Pan + Soil (wet)	22.60	22.30	22.56
Pan + Soil (dry)	17.88	17.91	18.18
Moisture Content	70.7%	65.8%	60.7%
Liquid Limit	67	65	63
Liquid Limit	65		

Plastic Limit

Pan ID	33	52
Pan Weight	2.44	2.42
Pan + Soil (wet)	12.28	13.01
Pan + Soil (dry)	10.03	10.60
Moisture Content	29.6%	29.5%
Plastic Limit	30	
Plastic Index	35	

USCS Classification: ASTM D 2487

Group Symbol SC

Group Name Clayey SAND

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

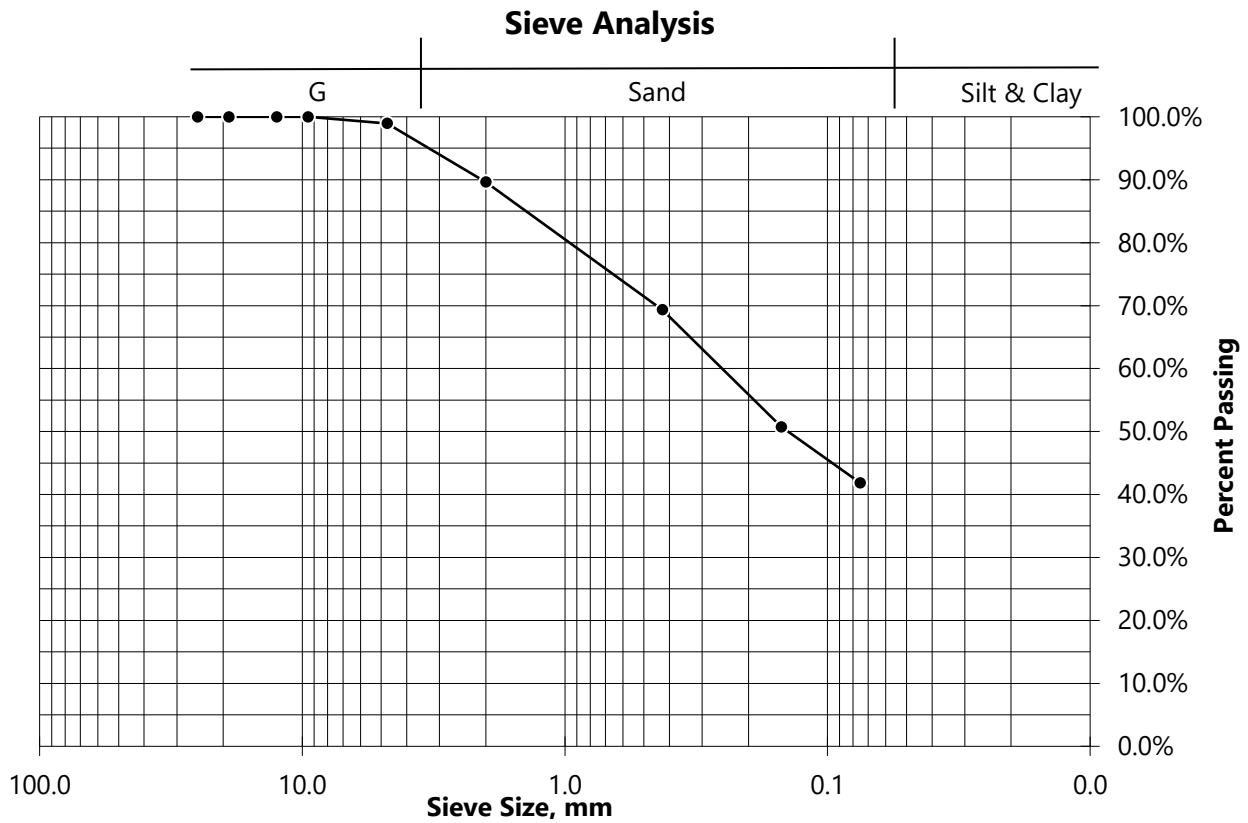
Prepared By: CBW

Sample ID DAA-35

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.95	1.1%	4.75	98.9%
No. 10	8.39	9.3%	2.00	89.6%
No. 40	18.25	20.3%	0.425	69.3%
No. 100	16.74	18.6%	0.15	50.7%
No. 200	8.03	8.9%	0.075	41.8%
Pan	0.41	0.5%		
Total	52.77	58.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-35

Sample Depth 6'-8'

Visual Sample Description Reddish-brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	30
Pan Wt	193.23 grams
Pan + Soil (wet)	330.76 grams
Pan + Soil (dry)	298.94 grams
Natural Moisture Content	30.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 257.27 grams

Percent Passing No. 200 Sieve 39.4%

Pan + Soil retained on No. 4 sieve

(dry) 193.23 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/9/2019

Liquid Limit

No of Blows	17	22	31
Pan ID	93	103	2000
Pan Wt	30.12	27.36	25.68
Pan + Soil (wet)	40.59	37.49	36.47
Pan + Soil (dry)	36.90	34.06	33.02
Moisture Content	54.5%	51.2%	47.0%
Liquid Limit	52	50	48
Liquid Limit	50		

Plastic Limit

Pan ID	19	22
Pan Weight	4.38	4.31
Pan + Soil (wet)	14.59	14.41
Pan + Soil (dry)	11.74	11.58
Moisture Content	38.7%	38.9%
Plastic Limit	39	
Plastic Index	11	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

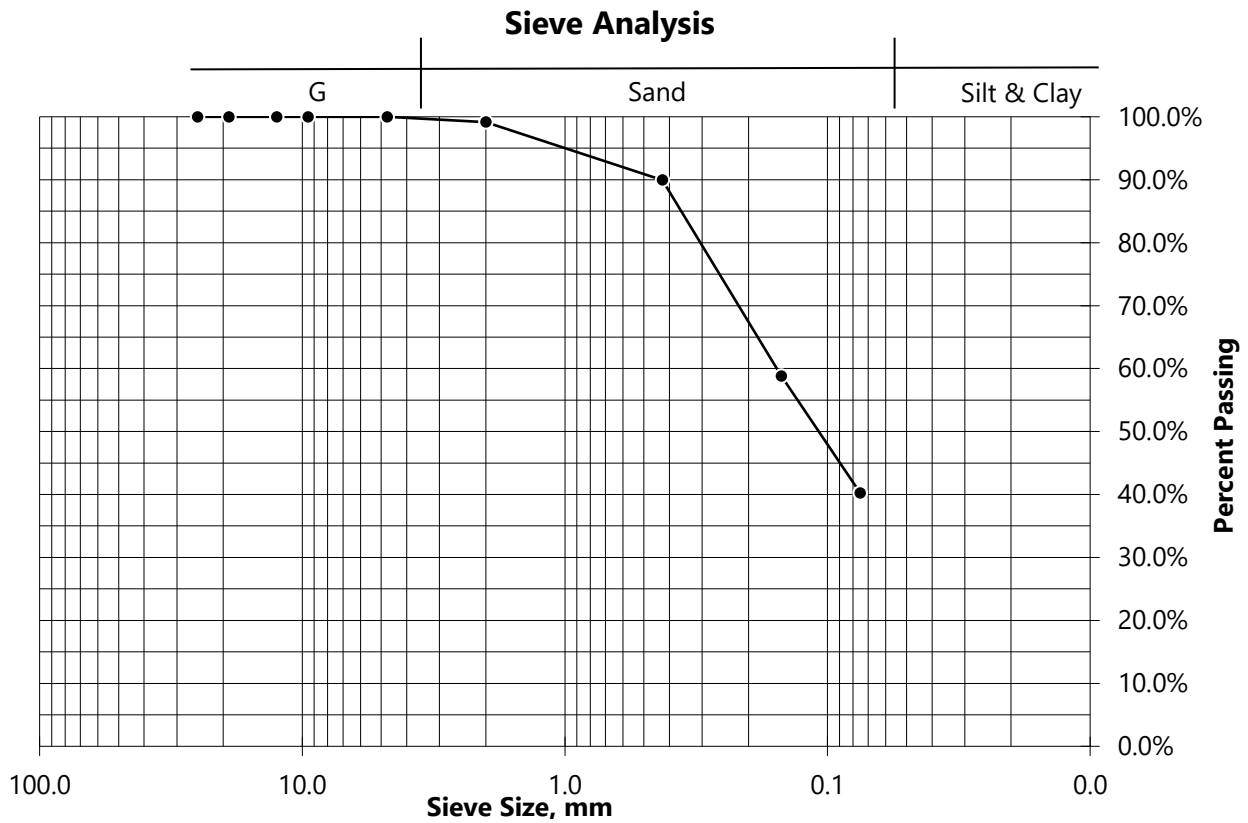
Prepared By: CBW

Sample ID DAA-35

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.88	0.8%	2.00	99.2%
No. 40	9.74	9.2%	0.425	90.0%
No. 100	32.89	31.1%	0.15	58.8%
No. 200	19.68	18.6%	0.075	40.2%
Pan	0.85	0.8%		
Total	64.04	60.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-36

Sample Depth 4'-6'

Visual Sample Description Reddish-brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	20
Pan Wt	190.00 grams
Pan + Soil (wet)	295.89 grams
Pan + Soil (dry)	268.23 grams
Natural Moisture Content	35.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 236.40 grams

Percent Passing No. 200 Sieve 40.7%

Pan + Soil retained on No. 4 sieve

(dry) 190.00 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/31/2019

Liquid Limit

No of Blows	18	23	32
Pan ID	72	70	64
Pan Wt	11.01	10.95	10.97
Pan + Soil (wet)	22.28	22.70	20.56
Pan + Soil (dry)	17.49	17.87	16.78
Moisture Content	73.9%	69.8%	65.0%
Liquid Limit	71	69	67
Liquid Limit	69		

Plastic Limit

Pan ID	75	82
Pan Weight	4.24	4.23
Pan + Soil (wet)	15.88	14.90
Pan + Soil (dry)	11.91	11.27
Moisture Content	51.7%	51.6%
Plastic Limit	52	
Plastic Index	17	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

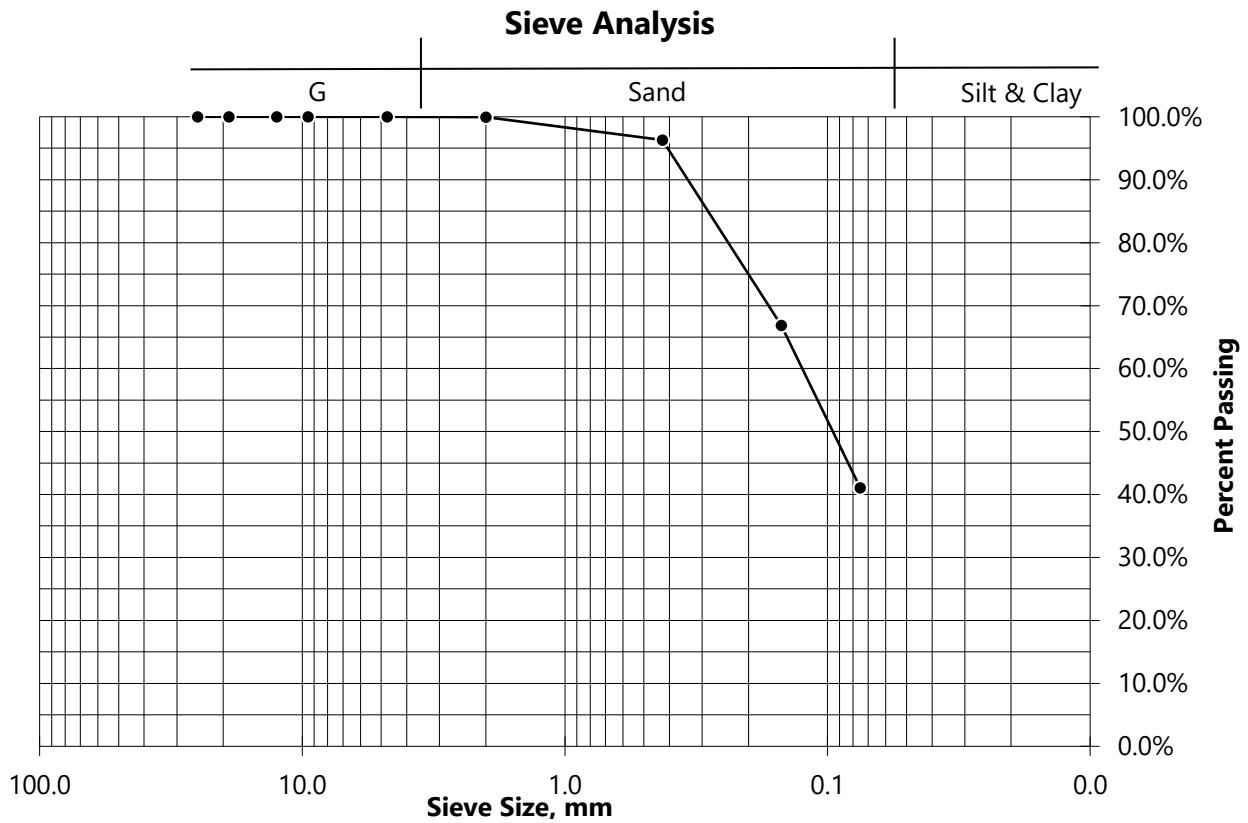
Prepared By: CBW

Sample ID DAA-36

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.06	0.1%	2.00	99.9%
No. 40	2.84	3.6%	0.425	96.3%
No. 100	23.02	29.4%	0.15	66.9%
No. 200	20.21	25.8%	0.075	41.0%
Pan	0.21	0.3%		
Total	46.34	59.2%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-36

Sample Depth 6'-8'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	122
Pan Wt	123.35 grams
Pan + Soil (wet)	240.36 grams
Pan + Soil (dry)	207.93 grams
Natural Moisture Content	38.3%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 167.12 grams

Percent Passing No. 200 Sieve 48.3%

Pan + Soil retained on No. 4 sieve

(dry) 123.35 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/3/2019

Liquid Limit

No of Blows	15	25	34
Pan ID	97	105	108
Pan Wt	26.03	29.25	33.13
Pan + Soil (wet)	35.05	45.44	49.58
Pan + Soil (dry)	31.68	39.77	44.09
Moisture Content	59.6%	53.9%	50.1%
Liquid Limit	56	54	52
Liquid Limit	54		

Plastic Limit

Pan ID	75	78
Pan Weight	4.25	4.22
Pan + Soil (wet)	13.42	13.09
Pan + Soil (dry)	11.10	10.83
Moisture Content	33.9%	34.2%
Plastic Limit	34	
Plastic Index	20	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

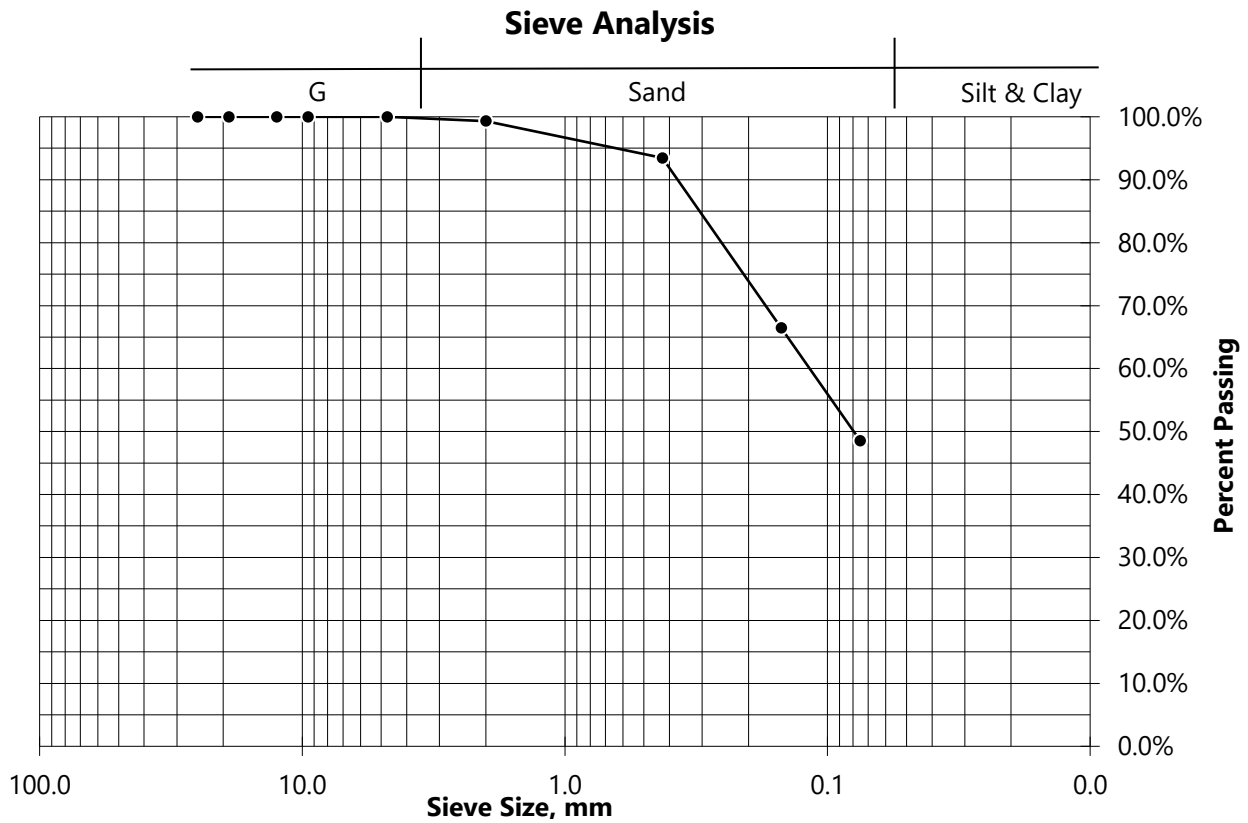
Prepared By: CBW

Sample ID DAA-36

Sample Depth 6'-8'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.58	0.7%	2.00	99.3%
No. 40	4.94	5.8%	0.425	93.5%
No. 100	22.85	27.0%	0.15	66.5%
No. 200	15.17	17.9%	0.075	48.5%
Pan	0.23	0.3%		
Total	43.77	51.7%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-36

Sample Depth 22'-24'

Visual Sample Description Light Brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	27
Pan Wt	193.73 grams
Pan + Soil (wet)	364.00 grams
Pan + Soil (dry)	322.86 grams
Natural Moisture Content	31.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 287.74 grams

Percent Passing No. 200 Sieve 27.2%

Pan + Soil retained on No. 4 sieve

(dry) 194.53 grams

Percent Passing No. 4 Sieve 99.4%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/31/2019

Liquid Limit

No of Blows	16	24	33
Pan ID	97	7	108
Pan Wt	26.03	11.18	33.13
Pan + Soil (wet)	31.71	23.16	44.41
Pan + Soil (dry)	29.88	19.54	41.21
Moisture Content	47.5%	43.3%	39.6%
Liquid Limit	45	43	41
Liquid Limit	43		

Plastic Limit

Pan ID	19	73
Pan Weight	4.37	4.24
Pan + Soil (wet)	16.38	16.92
Pan + Soil (dry)	13.68	14.08
Moisture Content	29.0%	28.9%
Plastic Limit	29	
Plastic Index	14	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

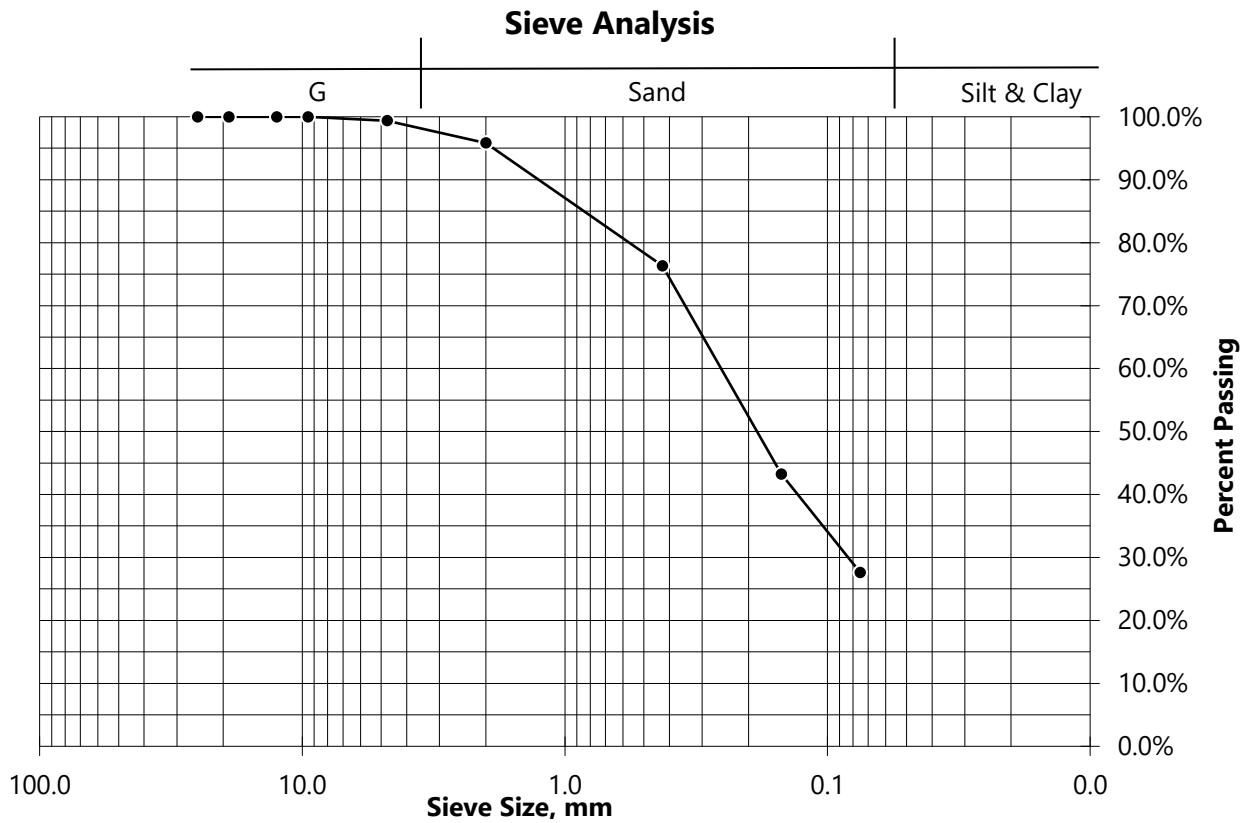
Prepared By: CBW

Sample ID DAA-36

Sample Depth 22'-24'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.80	0.6%	4.75	99.4%
No. 10	4.57	3.5%	2.00	95.8%
No. 40	25.19	19.5%	0.425	76.3%
No. 100	42.70	33.1%	0.15	43.3%
No. 200	20.24	15.7%	0.075	27.6%
Pan	0.51	0.4%		
Total	94.01	72.8%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-36

Sample Depth 35'-37'

Visual Sample Description Light Reddish-brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID	34
Pan Wt	192.79 grams
Pan + Soil (wet)	314.64 grams
Pan + Soil (dry)	290.95 grams
Natural Moisture Content	24.1%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 259.87 grams

Percent Passing No. 200 Sieve 31.7%

Pan + Soil retained on No. 4 sieve

(dry) 192.79 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/3/2019

Liquid Limit

No of Blows	15	26	31
Pan ID	101	107	2000
Pan Wt	23.99	25.10	25.67
Pan + Soil (wet)	35.58	37.10	33.29
Pan + Soil (dry)	31.94	33.62	31.19
Moisture Content	45.7%	40.8%	38.0%
Liquid Limit	43	41	39
Liquid Limit	41		

Plastic Limit

Pan ID	354	356
Pan Weight	9.16	9.10
Pan + Soil (wet)	23.82	26.44
Pan + Soil (dry)	20.46	22.45
Moisture Content	29.7%	29.9%
Plastic Limit	30	
Plastic Index	11	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

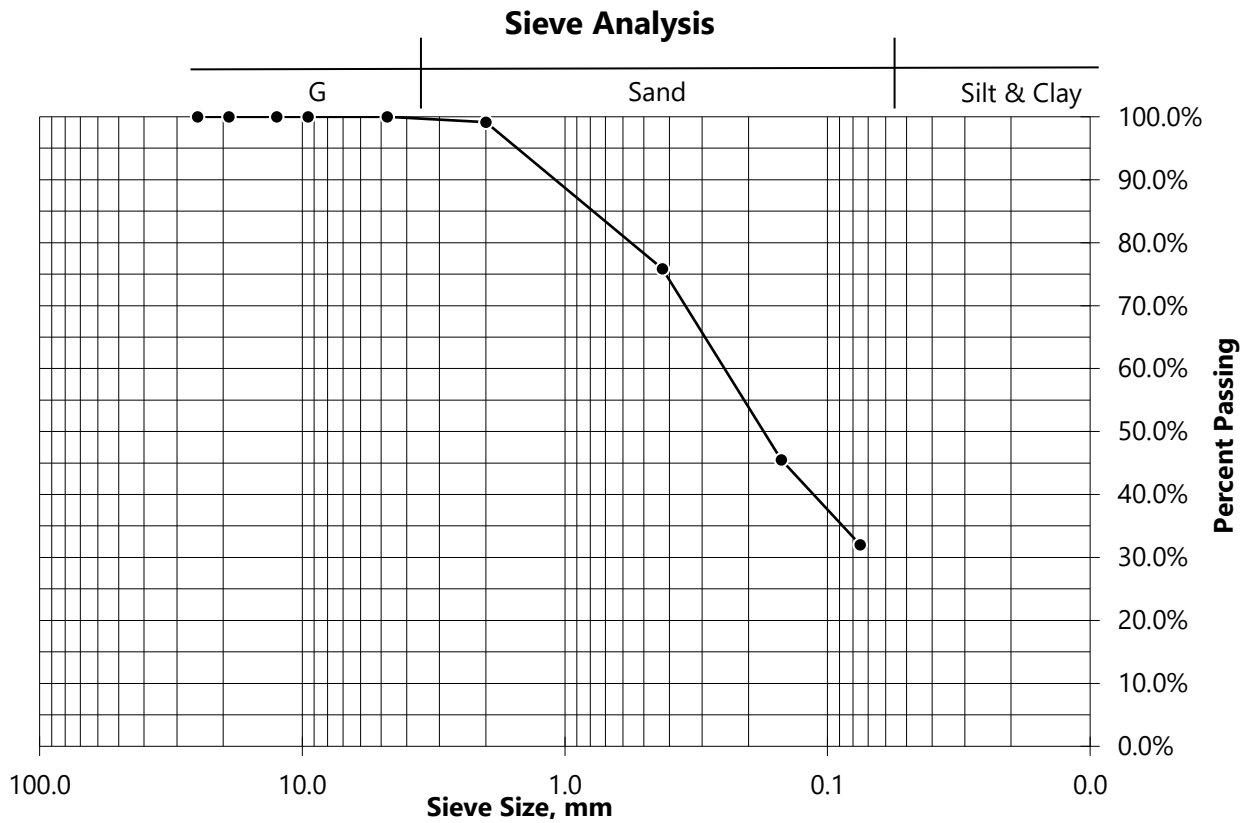
Prepared By: CBW

Sample ID DAA-36

Sample Depth 35'-37'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.85	0.9%	2.00	99.1%
No. 40	22.86	23.3%	0.425	75.8%
No. 100	29.78	30.3%	0.15	45.5%
No. 200	13.27	13.5%	0.075	32.0%
Pan	0.31	0.3%		
Total	67.07	68.3%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-37

Sample Depth 4'-6'

Visual Sample Description Red Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	108
Pan Wt	125.54 grams
Pan + Soil (wet)	238.24 grams
Pan + Soil (dry)	215.11 grams
Natural Moisture Content	25.8%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 173.89 grams

Percent Passing No. 200 Sieve 46.0%

Pan + Soil retained on No. 4 sieve

(dry) 125.54 grams

Percent Passing No. 4 Sieve 100.0%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/21/2019

Liquid Limit

No of Blows	16	26	34
Pan ID	10	71	69
Pan Wt	11.25	10.91	10.97
Pan + Soil (wet)	22.55	22.90	21.96
Pan + Soil (dry)	18.45	18.82	18.37
Moisture Content	57.0%	51.6%	48.5%
Liquid Limit	54	52	50
Liquid Limit	52		

Plastic Limit

Pan ID	353	315
Pan Weight	9.12	9.15
Pan + Soil (wet)	20.72	20.18
Pan + Soil (dry)	17.82	17.42
Moisture Content	33.3%	33.4%
Plastic Limit	33	
Plastic Index	19	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

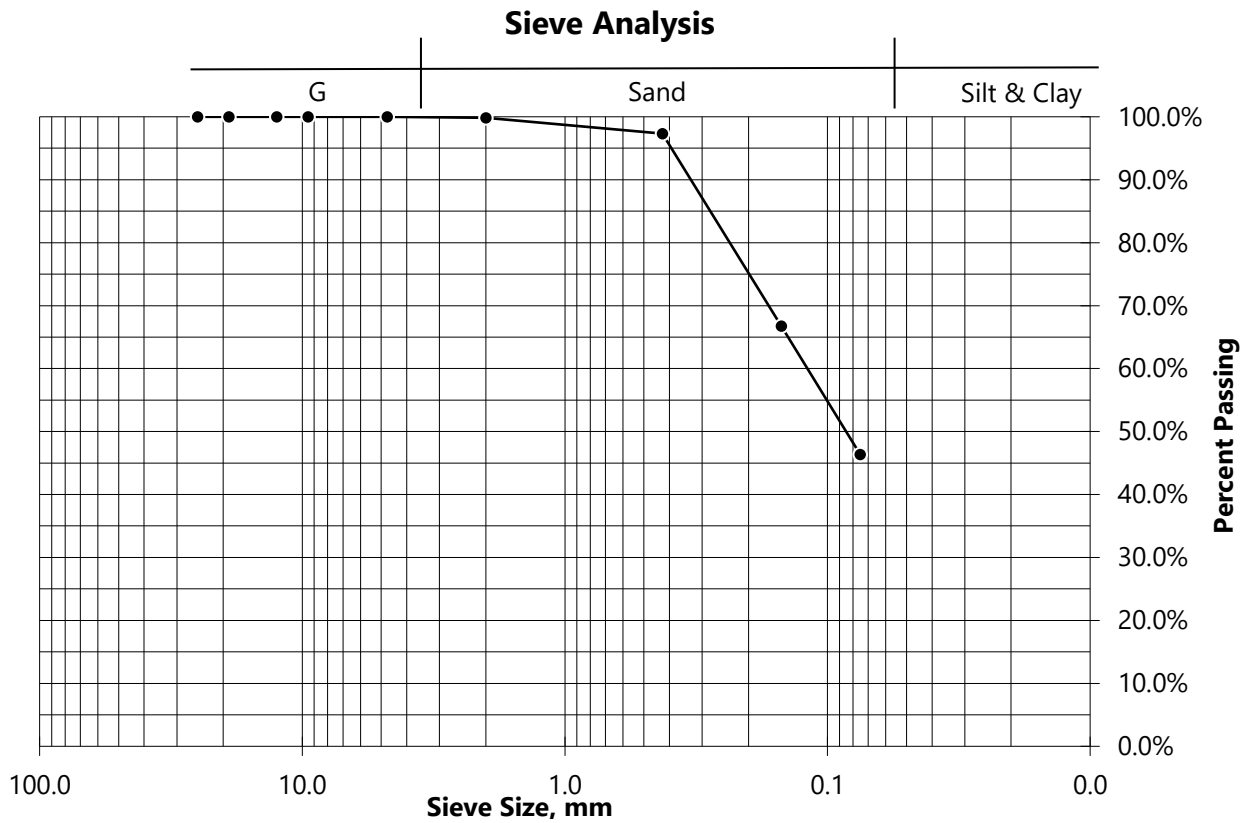
Prepared By: CBW

Sample ID DAA-37

Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.16	0.2%	2.00	99.8%
No. 40	2.26	2.5%	0.425	97.3%
No. 100	27.35	30.5%	0.15	66.8%
No. 200	18.30	20.4%	0.075	46.3%
Pan	0.28	0.3%		
Total	48.35	54.0%		



Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-40

Sample Depth 5'

Visual Sample Description Reddish-Brown Sandy Elastic SILT

Sample Received: 4/17/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	24
Pan Wt	186.14 grams
Pan + Soil (wet)	295.88 grams
Pan + Soil (dry)	271.59 grams
Natural Moisture Content	28.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 228.52 grams

Percent Passing No. 200 Sieve 50.4%

Pan + Soil retained on No. 4 sieve

(dry) 186.94 grams

Percent Passing No. 4 Sieve 99.1%

Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/29/2019

Liquid Limit

No of Blows	19	26	31
Pan ID	6	72	9
Pan Wt	11.18	11.08	11.11
Pan + Soil (wet)	31.14	28.22	33.35
Pan + Soil (dry)	23.82	22.20	25.87
Moisture Content	57.9%	54.1%	50.7%
Liquid Limit	56	54	52
Liquid Limit	54		

Plastic Limit

Pan ID	18	73
Pan Weight	4.33	4.24
Pan + Soil (wet)	14.66	15.30
Pan + Soil (dry)	11.98	12.47
Moisture Content	35.0%	34.4%
Plastic Limit	35	
Plastic Index	19	

USCS Classification: ASTM D 2487

Group Symbol MH

Group Name Sandy Elastic SILT

Grain Size Distribution Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-40

Sample Depth 5'

Mechanical Sieve Analysis: ASTM D 422

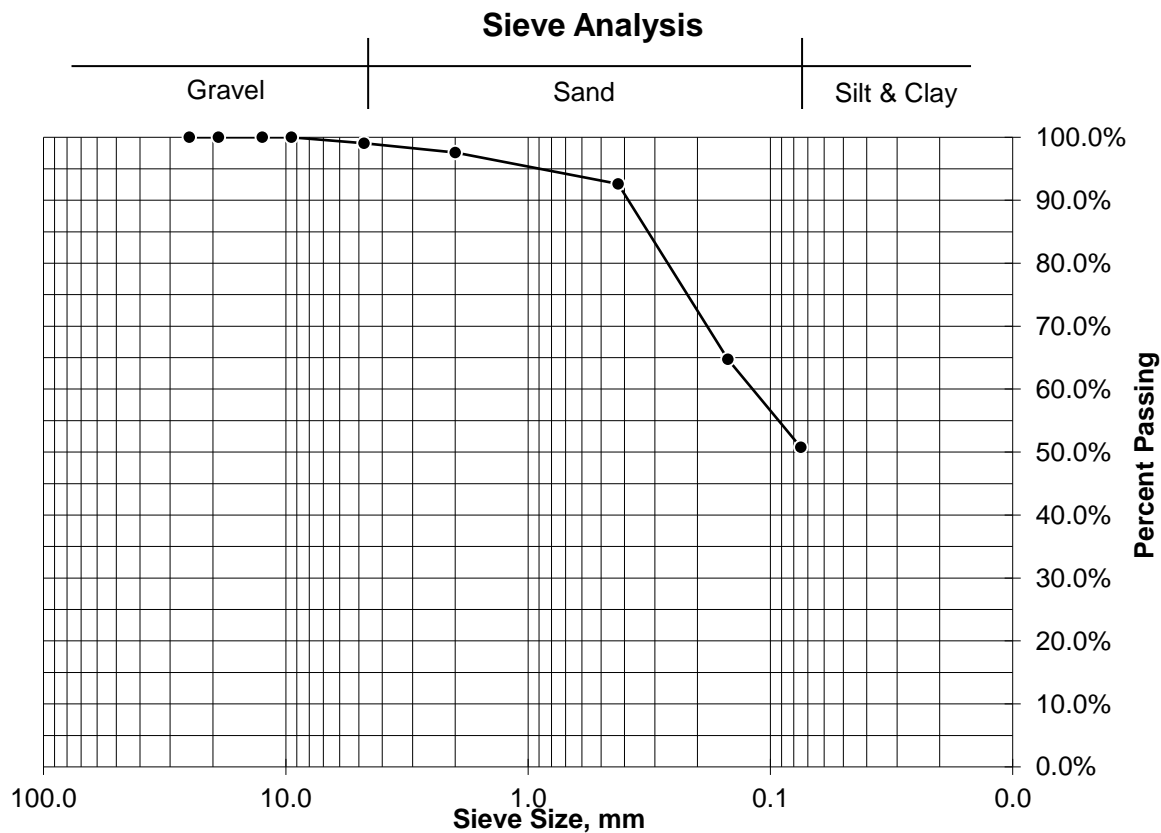


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Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.80	0.9%	4.75	99.1%
No. 10	1.28	1.5%	2.00	97.6%
No. 40	4.24	5.0%	0.425	92.6%
No. 100	23.80	27.9%	0.15	64.8%
No. 200	11.94	14.0%	0.075	50.8%
Pan	0.30	0.4%		
Total	42.36	49.6%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-40

Sample Depth 10'

Visual Sample Description Reddish-brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	35
Pan Wt	192.68 grams
Pan + Soil (wet)	303.95 grams
Pan + Soil (dry)	285.48 grams
Natural Moisture Content	19.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 247.54 grams

Percent Passing No. 200 Sieve 40.9%

Pan + Soil retained on No. 4 sieve

(dry) 193.35 grams

Percent Passing No. 4 Sieve 99.3%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/7/2019

Liquid Limit

No of Blows	16	29	30
Pan ID	101	64	107
Pan Wt	23.99	10.96	25.10
Pan + Soil (wet)	32.60	24.88	35.01
Pan + Soil (dry)	29.87	20.82	32.22
Moisture Content	46.4%	41.2%	39.1%
Liquid Limit	44	42	40
Liquid Limit	42		

Plastic Limit

Pan ID	75	315
Pan Weight	4.22	9.15
Pan + Soil (wet)	14.54	20.20
Pan + Soil (dry)	12.05	17.53
Moisture Content	31.8%	31.9%
Plastic Limit	32	
Plastic Index	10	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

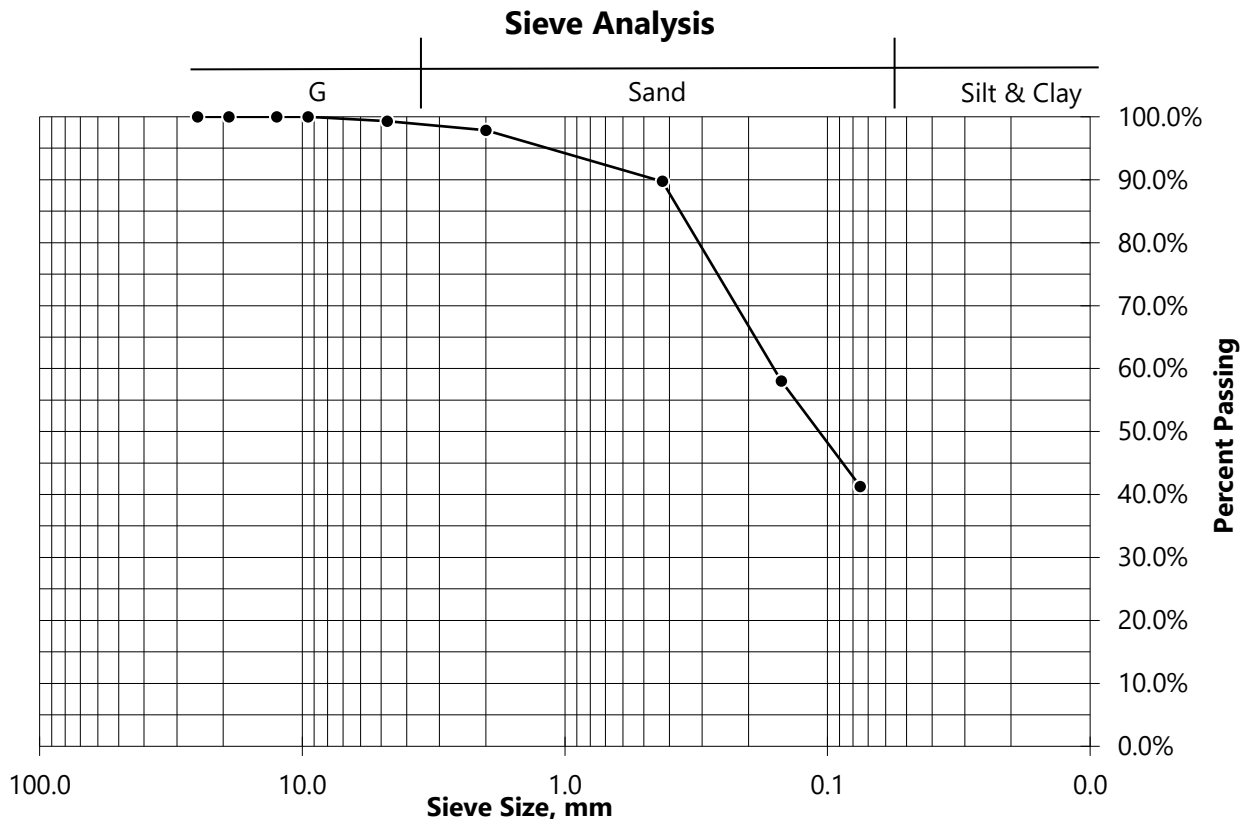
Prepared By: CBW

Sample ID DAA-40

Sample Depth 10'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.67	0.7%	4.75	99.3%
No. 10	1.32	1.4%	2.00	97.9%
No. 40	7.53	8.1%	0.425	89.7%
No. 100	29.43	31.7%	0.15	58.0%
No. 200	15.55	16.8%	0.075	41.3%
Pan	0.33	0.4%		
Total	54.83	59.1%		



Soil Classification Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100

Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-40

Sample Depth 15'

Visual Sample Description Brown Silty SAND

Sample Received: 4/15/2019

Date Tested: 4/17/2019

Natural Moisture Content: ASTM D 2216

Pan ID	114
Pan Wt	123.19 grams
Pan + Soil (wet)	230.16 grams
Pan + Soil (dry)	208.83 grams
Natural Moisture Content	24.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 170.44 grams

Percent Passing No. 200 Sieve 44.8%

Pan + Soil retained on No. 4 sieve

(dry) 123.37 grams

Percent Passing No. 4 Sieve 99.8%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 6/4/2019

Liquid Limit

No of Blows	15	25	34
Pan ID	92	93	94
Pan Wt	25.62	30.06	23.74
Pan + Soil (wet)	32.10	37.18	30.23
Pan + Soil (dry)	29.45	34.44	27.83
Moisture Content	69.1%	62.6%	58.8%
Liquid Limit	65	63	61
Liquid Limit	63		

Plastic Limit

Pan ID	76	79
Pan Weight	4.22	4.23
Pan + Soil (wet)	14.27	16.19
Pan + Soil (dry)	11.74	13.14
Moisture Content	33.6%	34.2%
Plastic Limit	34	
Plastic Index	29	

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Green Ridge, Cumberland Landfill

DAA# 18020117-030102

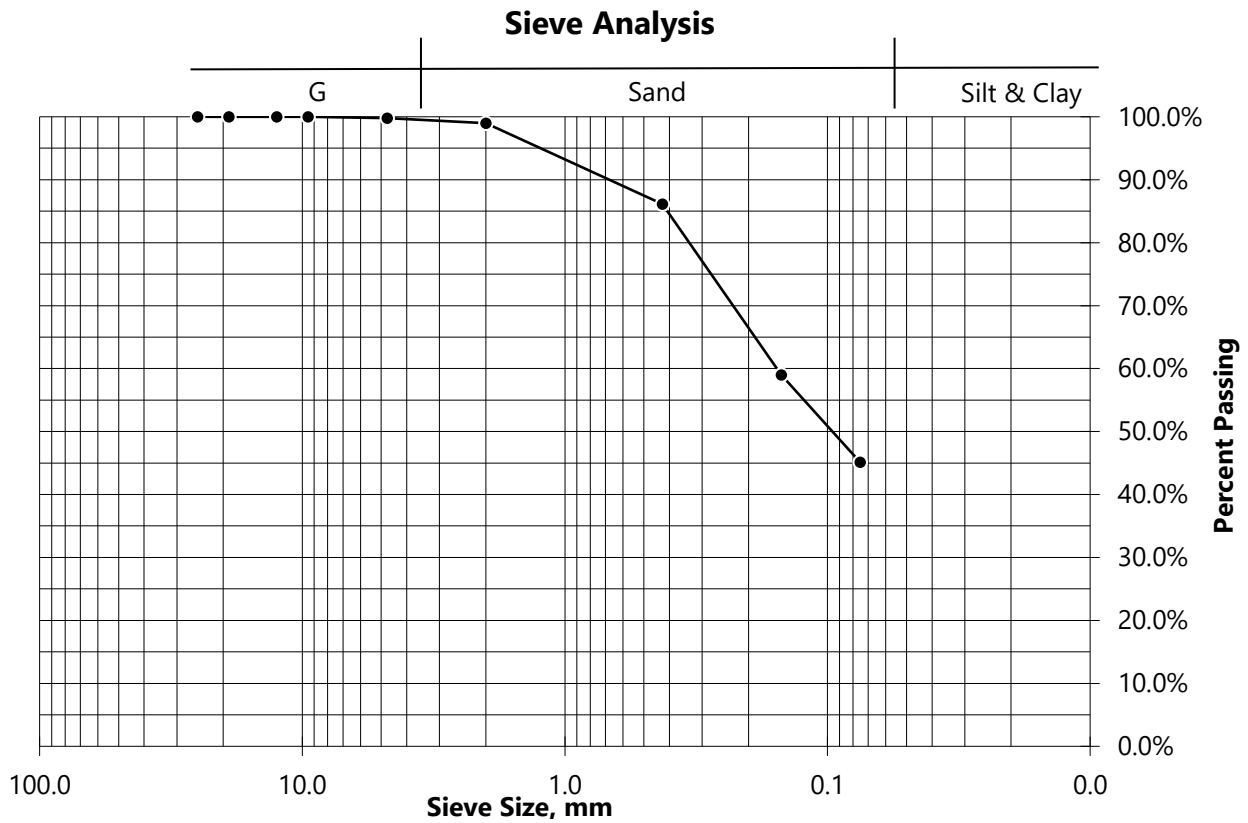
Prepared By: CBW

Sample ID DAA-40

Sample Depth 15'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.50	100.0%
No. 4	0.18	0.2%	4.75	99.8%
No. 10	0.70	0.8%	2.00	99.0%
No. 40	11.01	12.9%	0.425	86.1%
No. 100	23.23	27.1%	0.15	59.0%
No. 200	11.90	13.9%	0.075	45.1%
Pan	0.23	0.3%		
Total	47.25	55.2%		



Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW



1030 Wilmer Ave., Ste. 100
Richmond, VA 23227

Army Corps of Engineers Certified Laboratory

Sample ID DAA-40

Sample Depth 25'

Visual Sample Description Brown Silty SAND

Sample Received: 4/17/2019

Date Tested: 4/22/2019

Natural Moisture Content: ASTM D 2216

Pan ID	40
Pan Wt	192.72 grams
Pan + Soil (wet)	302.04 grams
Pan + Soil (dry)	290.44 grams
Natural Moisture Content	11.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve

(dry) 255.31 grams

Percent Passing No. 200 Sieve 35.9%

Pan + Soil retained on No. 4 sieve

(dry) 199.47 grams

Percent Passing No. 4 Sieve 93.1%

Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 5/1/2019

Liquid Limit

No of Blows			
Pan ID		Non-plastic	
Pan Wt			
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit			
Liquid Limit			

Plastic Limit

Pan ID		
Pan Weight	Non-plastic	
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content		
Plastic Limit		
Plastic Index		

USCS Classification: ASTM D 2487

Group Symbol **SM**

Group Name **Silty SAND**

Grain Size Distribution Calculations

Cumberland Landfill

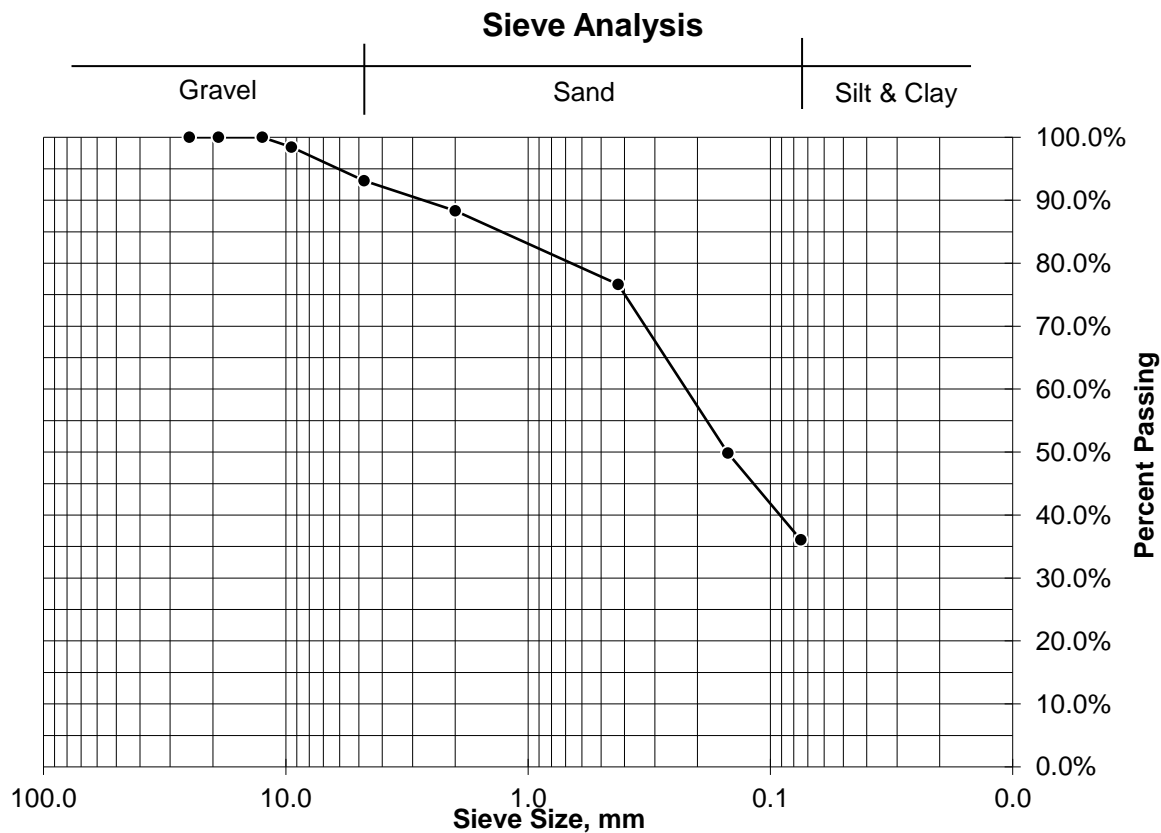
DAA# 18020117-030102

Prepared By: CBW

Sample ID DAA-40
Sample Depth 25'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	1.52	1.6%	9.50	98.4%
No. 4	5.23	5.4%	4.75	93.1%
No. 10	4.65	4.8%	2.00	88.3%
No. 40	11.45	11.7%	0.425	76.6%
No. 100	26.14	26.7%	0.15	49.9%
No. 200	13.47	13.8%	0.075	36.1%
Pan	0.13	0.1%		
Total	62.59	64.1%		



Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID East
 Sample Depth 0'-2.5'
 Visual Sample Description Brown Clayey SAND

Sample Received: 4/11/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID 101
 Pan Wt 122.74 grams
 Pan + Soil (wet) 486.18 grams
 Pan + Soil (dry) 454.83 grams
Natural Moisture Content 9.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve
 (dry) 342.33 grams
 Percent Passing No. 200 Sieve 33.9%
 Pan + Soil retained on No. 4 sieve
 (dry) 127.58 grams
 Percent Passing No. 4 Sieve 98.5%
Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/15/2019

Liquid Limit

No of Blows	18	23	33
Pan ID	1	72	65
Pan Wt	11.22	11.08	11.07
Pan + Soil (wet)	34.59	33.46	31.71
Pan + Soil (dry)	28.32	27.89	26.91
Moisture Content	36.7%	33.1%	30.3%
Liquid Limit	35	33	31
<i>Liquid Limit</i>	33		

Plastic Limit

Pan ID	313	354
Pan Weight	9.15	9.14
Pan + Soil (wet)	19.63	19.44
Pan + Soil (dry)	17.91	17.75
Moisture Content	19.6%	19.6%
<i>Plastic Limit</i>	20	
<i>Plastic Index</i>	13	

USCS Classification: ASTM D 2487

Group Symbol **SC**

Group Name **Clayey SAND**

Grain Size Distribution Calculations

Cumberland Landfill

DAA# 18020117-030102

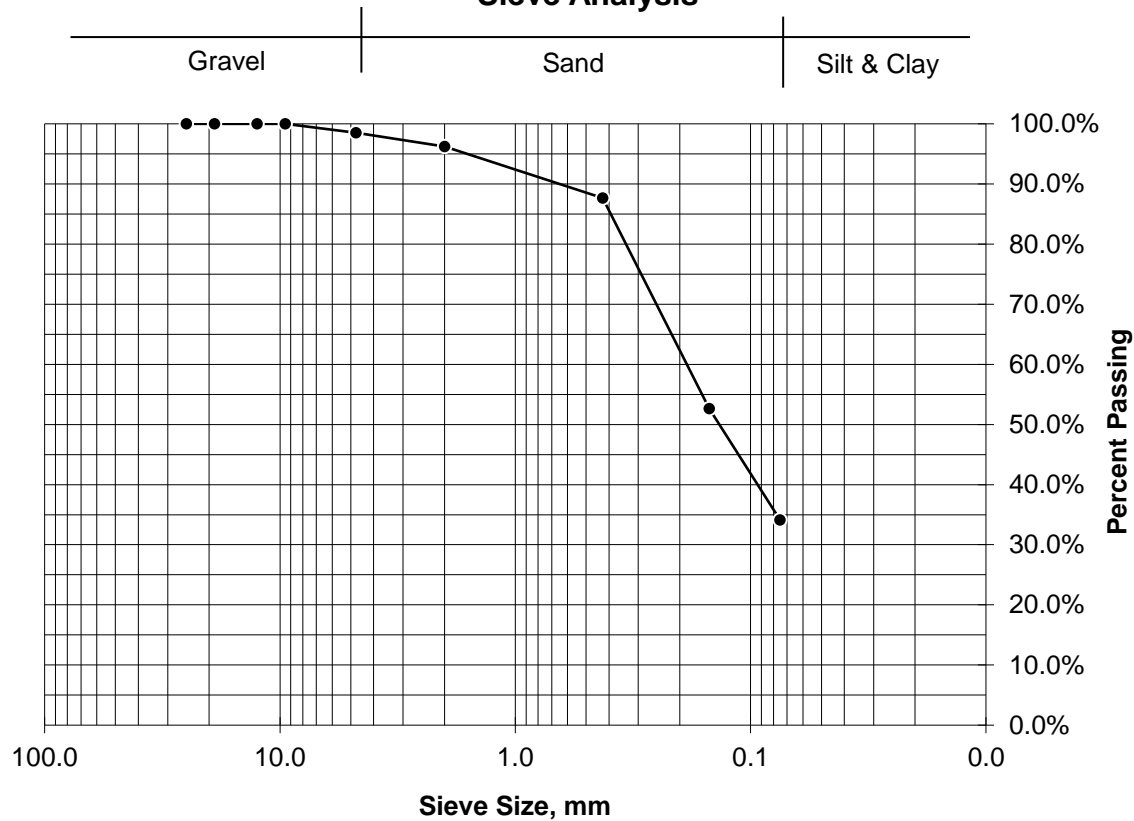
Prepared By: CBW

Sample ID East
Sample Depth 0'-2.5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	4.84	1.5%	4.75	98.5%
No. 10	7.67	2.3%	2.0	96.2%
No. 40	28.50	8.6%	0.425	87.7%
No. 100	116.30	35.0%	0.15	52.6%
No. 200	61.42	18.5%	0.075	34.1%
Pan	0.84	0.3%		
Total	219.57	66.1%		

Sieve Analysis



Proctor Test Report
Cumberland Landfill
DAA# 18020117-030102
Prepared By: CBW

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Richmond, VA 23227
Army Corps of Engineers Certified Laboratory

Soil and Test Method Data

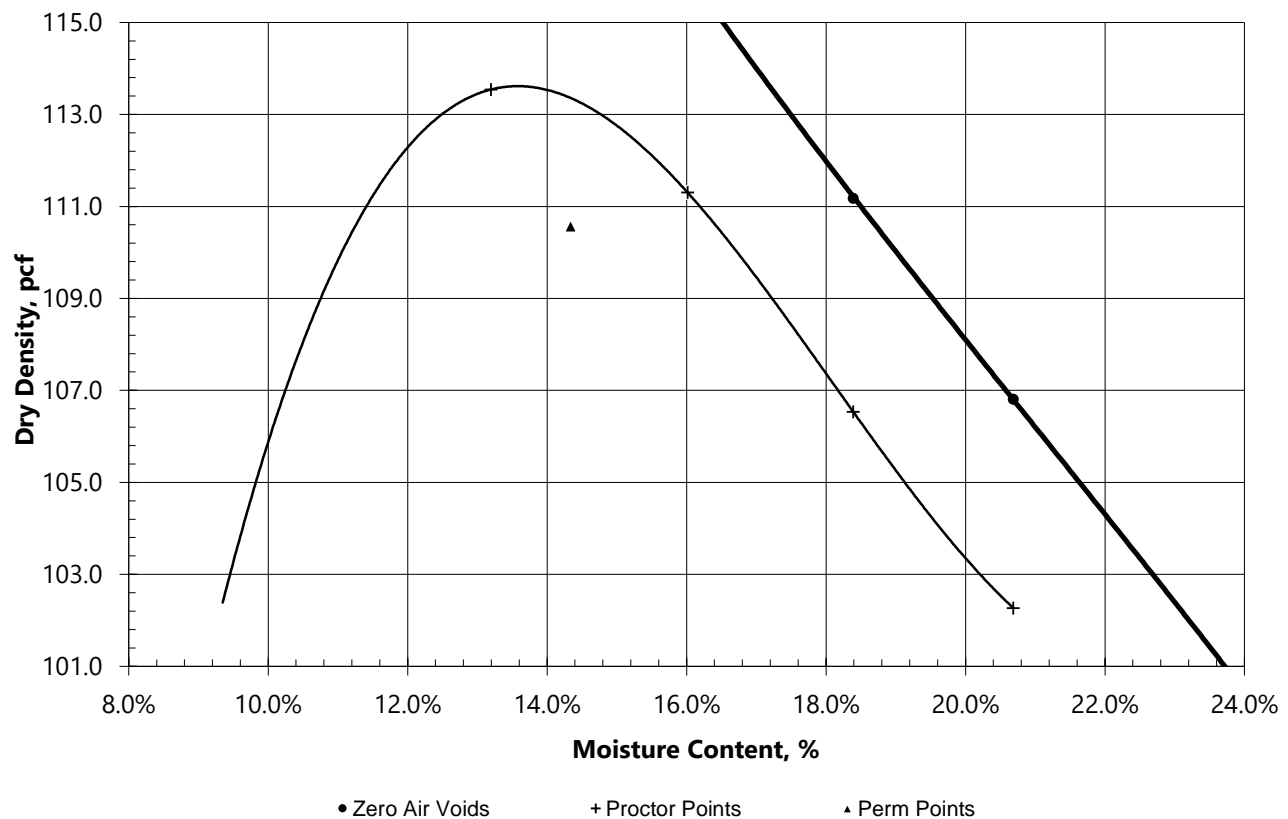
Sample ID East
Sample Depth 0'-2.5'
Sample Classification Clayey SAND
USCS Group Symbol SC
Test Method ASTM D698, Method B, with mechanical hammer
Sample Preparation Air dried and sieved through a 3/8" sieve.
Mold Size, in 4.0
Assumed Specific Gravity: 2.65

Sample Received: 4/11/2019
Date Tested: 4/18/2019

Test Data	#1	#2	#3	#4	#5
Moisture Content	13.2%	16.0%	18.4%	20.7%	
Dry Density, pcf	113.5	111.3	106.5	102.3	

Moisture-Density Curve

Maximum Dry Density, pcf = 113.7 , Optimum Moisture, % = 13.6



Permeability Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID: East
 Sample Depth: 0'-2.5'
 Permeability Method: ASTM D5084
 Sample Length, in: 3.26
 Sample Diameter, in: 2.86
 Sample Condition: Remolded

Sample Received: 4/11/2019
 Date Tested: 5/1/2019

Moisture Content

Pan Wt 6.64 grams
 Pan + Soil (wet) 342.71 grams
 Pan + Soil (dry) 300.57 grams
 Moisture Content 14.3%

Dry Density

Soil (wet) 695.38 grams
 Wet Density 126.5 pcf
 Dry Density 110.6 pcf

Test Conditions

Backpressure, psi 40.0
 Cell Pressure, psi 50.0
 Influent Buret Area, cm² 0.03142
 Effluent Buret Area, cm² 0.76712
 Effective Stress, psi 10.0
 Pearment Liquid Temp.(°C):

De-aired Water

Initial Data

Assumed Specific Gravity 2.65
 Percent Voids 33.1%
 Actual Volume of Voids 113.7 ml
 Porosity 33.1%
 Saturation 76.7%

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm ³	Effluent Head, cm	Effluent Flow, cm ³	Flow Deviation Ratio	Gradient mm-Hg	Permeability, k cm/sec
2-May 17:50	15.500		1.600				
2-May 17:51	15.000	0.016	1.620	0.016	1.00	21.07	3.1E-07
2-May 17:52	14.800	0.006	1.629	0.006	1.00	20.28	1.3E-07
2-May 17:53	14.500	0.009	1.641	0.009	1.00	19.96	1.9E-07
2-May 17:54	14.000	0.016	1.661	0.016	1.00	19.49	3.3E-07
2-May 17:55	13.700	0.009	1.674	0.009	1.00	18.70	2.1E-07
2-May 17:56	13.500	0.006	1.682	0.006	1.00	18.23	1.4E-07
2-May 17:57	13.300	0.006	1.690	0.006	1.00	17.91	1.4E-07
2-May 17:58	13.200	0.003	1.694	0.003	1.00	17.60	7.2E-08
2-May 18:04	12.500	0.022	1.723	0.022	1.00	17.44	8.7E-08

Average Permeability

1.1E-07 cm/sec

Corrected for 20°C

Final Data

Assumed Specific Gravity 2.65
 Final Weight of Sample 719.46 grams
 Final Moisture Content 18.3%
 Percent Voids 32.3%
 Actual Volume of Voids 109.4 ml
 Porosity 32.3%
 Saturation 100.0%

Final Sample Length, in: 3.22
 Final Sample Diameter, in: 2.86
 Wet Density 132.5 pcf
 Dry Density 112.0 pcf

Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID East
 Sample Depth 2.5'-5'
 Visual Sample Description Light Brown Clayey SAND

Sample Received: 4/11/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID 104
 Pan Wt 125.63 grams
 Pan + Soil (wet) 538.52 grams
 Pan + Soil (dry) 515.37 grams
Natural Moisture Content 5.9%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve
 (dry) 398.08 grams
 Percent Passing No. 200 Sieve 30.1%
 Pan + Soil retained on No. 4 sieve
 (dry) 126.51 grams
 Percent Passing No. 4 Sieve 99.8%
Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/26/2019

Liquid Limit

No of Blows	16	22	35
Pan ID	107	102	96
Pan Wt	25.10	23.97	24.80
Pan + Soil (wet)	42.64	42.16	43.15
Pan + Soil (dry)	37.79	37.49	38.84
Moisture Content	38.2%	34.5%	30.7%
Liquid Limit	36	34	32
<i>Liquid Limit</i>	34		

Plastic Limit

Pan ID	315	316
Pan Weight	9.16	9.08
Pan + Soil (wet)	21.90	19.35
Pan + Soil (dry)	19.81	17.66
Moisture Content	19.6%	19.7%
<i>Plastic Limit</i>	20	
<i>Plastic Index</i>	14	

USCS Classification: ASTM D 2487

Group Symbol **SC**

Group Name **Clayey SAND**

Grain Size Distribution Calculations

Cumberland Landfill

DAA# 18020117-030102

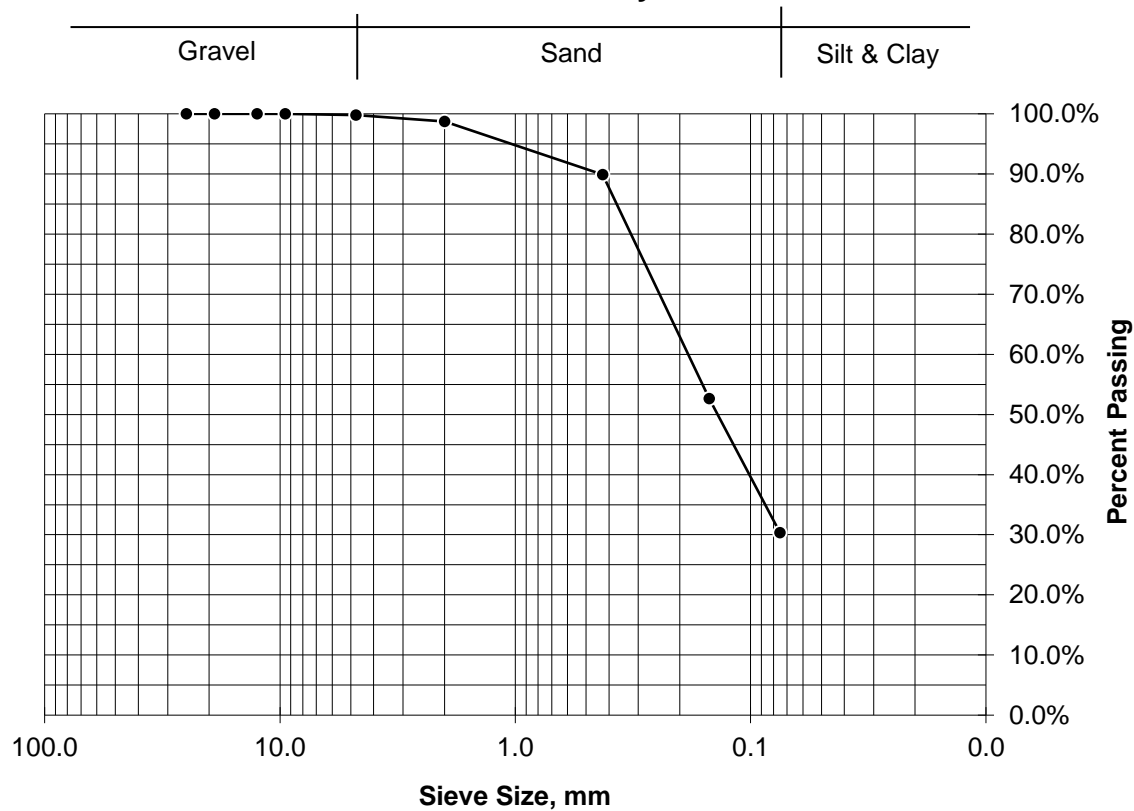
Prepared By: CBW

Sample ID East
Sample Depth 2.5'-5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.88	0.2%	4.75	99.8%
No. 10	4.05	1.0%	2.0	98.7%
No. 40	34.43	8.8%	0.425	89.9%
No. 100	145.18	37.3%	0.15	52.7%
No. 200	87.01	22.3%	0.075	30.3%
Pan	0.90	0.2%		
Total	272.45	69.9%		

Sieve Analysis



Proctor Test Report
Cumberland Landfill
DAA# 18020117-030102
Prepared By: CBW

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 Richmond, VA 23227
Army Corps of Engineers Certified Laboratory

Soil and Test Method Data

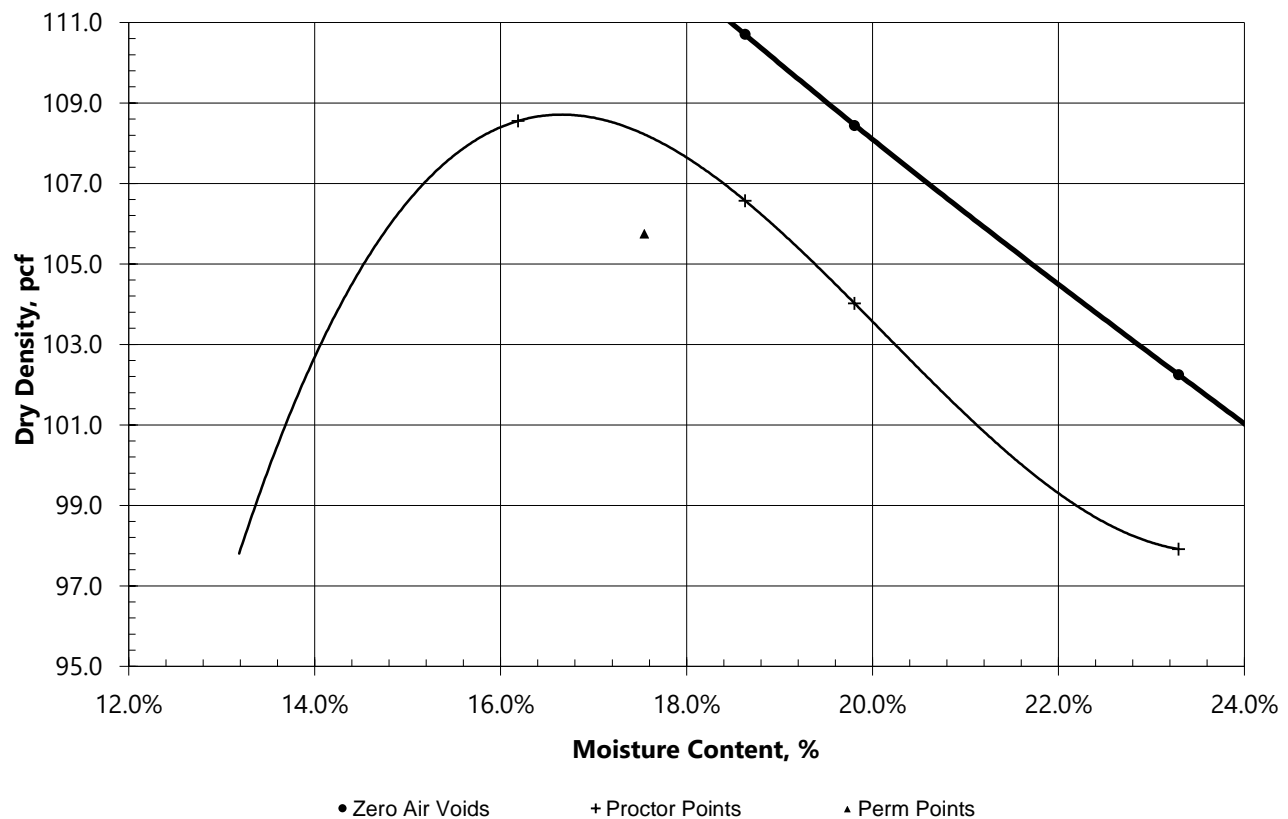
Sample ID East
 Sample Depth 2.5'-5'
 Sample Classification Clayey SAND
 USCS Group Symbol SC
 Test Method ASTM D698, Method B, with mechanical hammer
 Sample Preparation Air dried and sieved through a 3/8" sieve.
 Mold Size, in 4.0
 Assumed Specific Gravity: 2.65

Sample Received: 4/11/2019
 Date Tested: 4/18/2019

Test Data	#1	#2	#3	#4	#5
Moisture Content	16.2%	18.6%	19.8%	23.3%	
Dry Density, pcf	108.6	106.6	104.0	97.9	

Moisture-Density Curve

Maximum Dry Density, pcf = 108.8 , Optimum Moisture, % = 16.7



Permeability Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID: East
 Sample Depth: 2.5'-5'
 Permeability Method: ASTM D5084
 Sample Length, in: 3.29
 Sample Diameter, in: 2.85
 Sample Condition: Remolded

Sample Received: 4/11/2019
 Date Tested: 5/1/2019

Moisture Content

Pan Wt 6.62 grams
 Pan + Soil (wet) 307.15 grams
 Pan + Soil (dry) 262.29 grams
 Moisture Content 17.5%

Dry Density

Soil (wet) 685.35 grams
 Wet Density 124.4 pcf
 Dry Density 105.8 pcf

Test Conditions

Backpressure, psi 40.0
 Cell Pressure, psi 50.0
 Influent Buret Area, cm² 0.03142
 Effluent Buret Area, cm² 0.76712
 Effective Stress, psi 10.0
 Pearment Liquid Temp.(°C):

De-aired Water

Initial Data

Assumed Specific Gravity 2.65
 Percent Voids 36.0%
 Actual Volume of Voids 123.9 ml
 Porosity 36.0%
 Saturation 82.6%

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm ³	Effluent Head, cm	Effluent Flow, cm ³	Flow Deviation Ratio	Gradient mm-Hg	Permeability, k cm/sec
2-May 17:35	15.700		1.600				
2-May 17:36	15.400	0.009	1.612	0.009	1.00	21.18	1.8E-07
2-May 17:37	15.100	0.009	1.625	0.009	1.00	20.71	1.9E-07
2-May 17:38	14.900	0.006	1.633	0.006	1.00	20.24	1.3E-07
2-May 17:39	14.700	0.006	1.641	0.006	1.00	19.92	1.3E-07
2-May 17:40	14.500	0.006	1.649	0.006	1.00	19.61	1.3E-07
2-May 17:41	14.300	0.006	1.657	0.006	1.00	19.30	1.3E-07
2-May 17:42	14.100	0.006	1.666	0.006	1.00	18.99	1.4E-07
2-May 17:43	13.950	0.005	1.672	0.005	1.00	18.67	1.0E-07
2-May 17:48	13.700	0.008	1.682	0.008	1.00	18.44	3.5E-08

Average Permeability

1.0E-07 cm/sec

Corrected for 20°C

Final Data

Assumed Specific Gravity 2.65
 Final Weight of Sample 704.08 grams
 Final Moisture Content 20.8%
 Percent Voids 35.7%
 Actual Volume of Voids 122.1 ml
 Porosity 35.7%
 Saturation 99.1%

Final Sample Length, in: 3.25
 Final Sample Diameter, in: 2.86
 Wet Density 128.4 pcf
 Dry Density 106.4 pcf

Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID West
 Sample Depth 0'-2.5'
 Visual Sample Description Brown Clayey SAND

Sample Received: 4/11/2019

Date Tested: 4/15/2019

Natural Moisture Content: ASTM D 2216

Pan ID 5
 Pan Wt 194.83 grams
 Pan + Soil (wet) 551.40 grams
 Pan + Soil (dry) 495.88 grams
Natural Moisture Content 18.4%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve
 (dry) 354.62 grams
 Percent Passing No. 200 Sieve 46.9%
 Pan + Soil retained on No. 4 sieve
 (dry) 196.72 grams
 Percent Passing No. 4 Sieve 99.4%
Soil Classifies as Coarse-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/26/2019

Liquid Limit

No of Blows	17	23	31
Pan ID	64	69	70
Pan Wt	10.99	10.97	10.99
Pan + Soil (wet)	31.87	28.30	29.17
Pan + Soil (dry)	24.06	22.08	22.96
Moisture Content	59.7%	56.0%	51.8%
Liquid Limit	57	55	53
<i>Liquid Limit</i>	55		

Plastic Limit

Pan ID	2	4
Pan Weight	9.01	9.00
Pan + Soil (wet)	19.06	19.15
Pan + Soil (dry)	17.23	17.30
Moisture Content	22.3%	22.3%
<i>Plastic Limit</i>	22	
<i>Plastic Index</i>	33	

USCS Classification: ASTM D 2487

Group Symbol **SC**

Group Name **Clayey SAND**

Grain Size Distribution Calculations

Cumberland Landfill

DAA# 18020117-030102

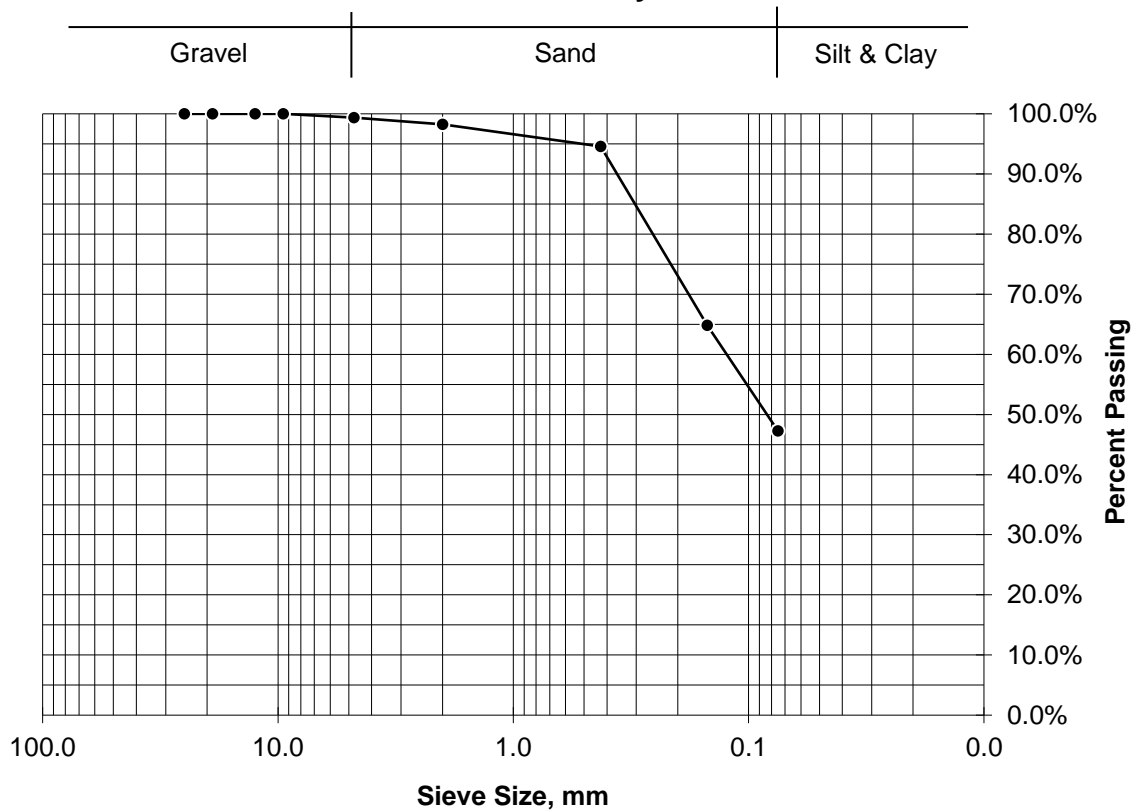
Prepared By: CBW

Sample ID West
Sample Depth 0'-2.5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	1.89	0.6%	4.75	99.4%
No. 10	3.42	1.1%	2.0	98.2%
No. 40	11.00	3.7%	0.425	94.6%
No. 100	89.53	29.7%	0.15	64.8%
No. 200	52.95	17.6%	0.075	47.3%
Pan	0.99	0.3%		
Total	159.78	53.1%		

Sieve Analysis



Proctor Test Report
Cumberland Landfill
DAA# 18020117-030102
Prepared By: CBW

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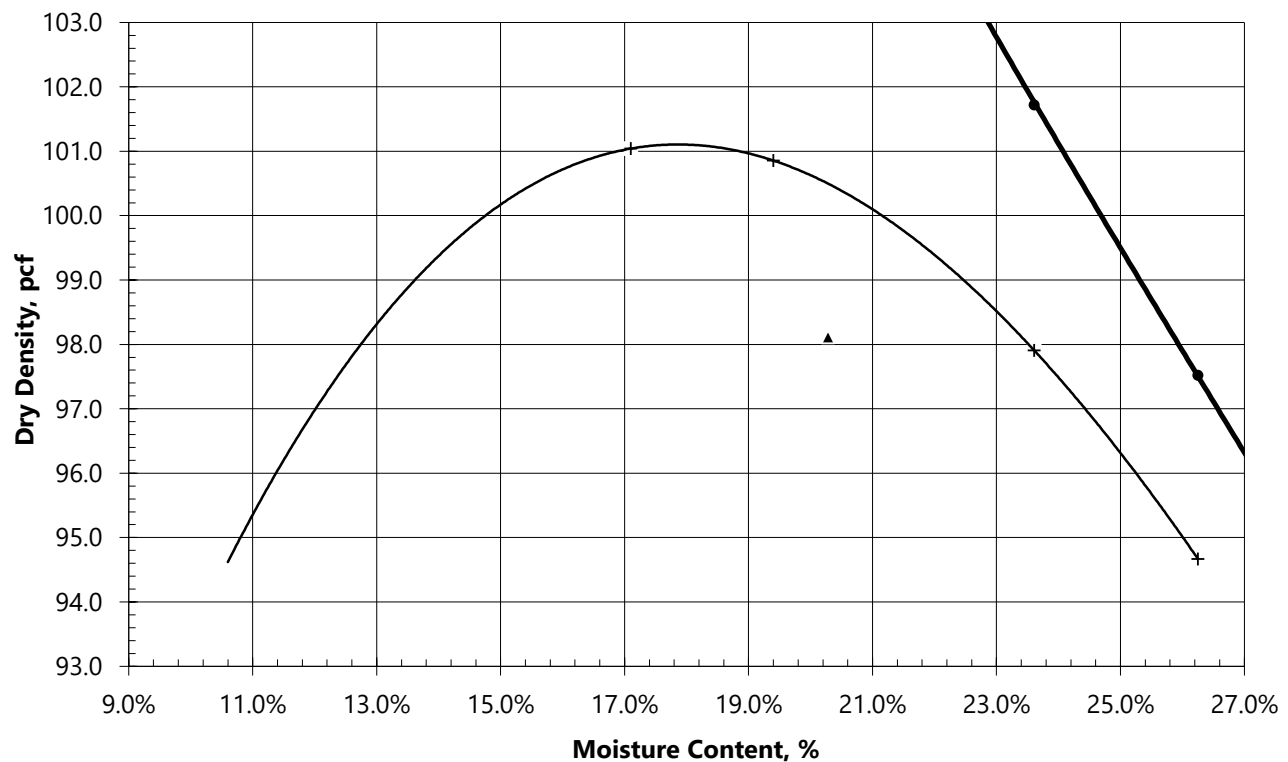
Soil and Test Method Data

Sample ID West	Sample Recieved: 4/11/2019
Sample Depth 0'-2.5'	Date Tested: 4/18/2019
Sample Classification Clayey SAND	
USCS Group Symbol SC	
Test Method ASTM D698, Method B, with mechanical hammer	
Sample Preparation Air dried and sieved through a 3/8" sieve.	
Mold Size, in 4.0	
Assumed Specific Gravity: 2.65	

Test Data	#1	#2	#3	#4	#5
Moisture Content	17.1%	19.4%	23.6%	26.3%	
Dry Density, pcf	101.0	100.9	97.9	94.7	

Moisture-Density Curve

Maximum Dry Density, pcf = 101.2 , Optimum Moisture, % = 18.0



• Zero Air Voids + Proctor Points ▲ Perm Points

Permeability Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID: West
 Sample Depth: 0'-2.5'
 Permeability Method: ASTM D5084
 Sample Length, in: 3.62
 Sample Diameter, in: 2.85
 Sample Condition: Remolded

Sample Received: 4/11/2019
 Date Tested: 5/1/2019

Moisture Content

Pan Wt 6.59 grams
 Pan + Soil (wet) 218.55 grams
 Pan + Soil (dry) 182.81 grams
 Moisture Content 20.3%

Dry Density

Soil (wet) 715.49 grams
 Wet Density 118.0 pcf
 Dry Density 98.1 pcf

Test Conditions

Backpressure, psi 40.0
 Cell Pressure, psi 50.0
 Influent Buret Area, cm² 0.03142
 Effluent Buret Area, cm² 0.76712
 Effective Stress, psi 10.0
 Pearment Liquid Temp.(°C):

De-aired Water

Initial Data

Assumed Specific Gravity 2.65
 Percent Voids 40.7%
 Actual Volume of Voids 153.9 ml
 Porosity 40.7%
 Saturation 78.4%

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm ³	Effluent Head, cm	Effluent Flow, cm ³	Flow Deviation Ratio	Gradient mm-Hg	Permeability, k cm/sec
2-May 16:55	15.500		1.600				
2-May 16:56	15.000	0.016	1.620	0.016	1.00	18.97	3.4E-07
2-May 16:57	14.800	0.006	1.629	0.006	1.00	18.26	1.4E-07
2-May 16:58	14.600	0.006	1.637	0.006	1.00	17.98	1.4E-07
2-May 16:59	14.400	0.006	1.645	0.006	1.00	17.69	1.4E-07
2-May 17:00	14.200	0.006	1.653	0.006	1.00	17.41	1.5E-07
2-May 17:01	14.100	0.003	1.657	0.003	1.00	17.13	7.5E-08
2-May 17:02	14.000	0.003	1.661	0.003	1.00	16.98	7.5E-08
2-May 17:03	13.900	0.003	1.666	0.003	1.00	16.84	7.6E-08
2-May 17:08	13.400	0.016	1.686	0.016	1.00	16.70	7.8E-08

Average Permeability

7.6E-08 cm/sec

Corrected for 20°C

Final Data

Assumed Specific Gravity 2.65
 Final Weight of Sample 745.09 grams
 Final Moisture Content 25.3%
 Percent Voids 40.4%
 Actual Volume of Voids 152.4 ml
 Porosity 40.4%
 Saturation 98.6%

Final Sample Length, in: 3.58
 Final Sample Diameter, in: 2.86
 Wet Density 123.4 pcf
 Dry Density 98.5 pcf

Soil Classification Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID West
 Sample Depth 2.5'-5'
 Visual Sample Description Brown Sandy Fat CLAY

Sample Received: 4/11/2019

Date Tested: 4/16/2019

Natural Moisture Content: ASTM D 2216

Pan ID 111
 Pan Wt 123.54 grams
 Pan + Soil (wet) 443.36 grams
 Pan + Soil (dry) 396.90 grams
Natural Moisture Content 17.0%

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve
 (dry) 237.27 grams
 Percent Passing No. 200 Sieve 58.4%
 Pan + Soil retained on No. 4 sieve
 (dry) 123.81 grams
 Percent Passing No. 4 Sieve 99.9%
Soil Classifies as Fine-Grained Soil

Atterberg Limits: ASTM D 4318

Date Tested: 4/29/2019

Liquid Limit

No of Blows	18	21	32
Pan ID	92	94	108
Pan Wt	25.60	23.78	33.14
Pan + Soil (wet)	43.31	40.76	50.43
Pan + Soil (dry)	36.76	34.75	44.60
Moisture Content	58.7%	54.8%	50.9%
Liquid Limit	56	54	52
<i>Liquid Limit</i>	54		

Plastic Limit

Pan ID	75	78
Pan Weight	4.26	4.25
Pan + Soil (wet)	14.50	14.80
Pan + Soil (dry)	12.67	12.90
Moisture Content	21.8%	22.0%
<i>Plastic Limit</i>	22	
<i>Plastic Index</i>	32	

USCS Classification: ASTM D 2487

Group Symbol **CH**

Group Name **Sandy Fat CLAY**

Grain Size Distribution Calculations

Cumberland Landfill

DAA# 18020117-030102

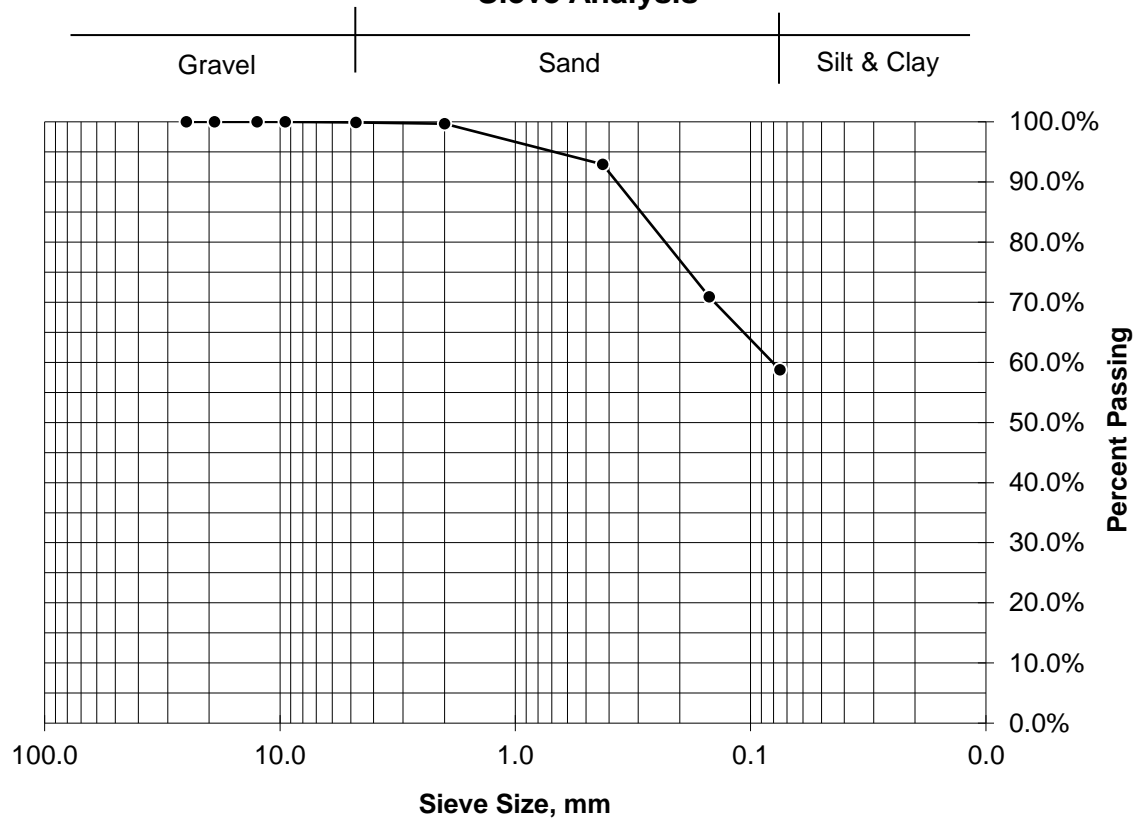
Prepared By: CBW

Sample ID West
Sample Depth 2.5'-5'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.27	0.1%	4.75	99.9%
No. 10	0.60	0.2%	2.0	99.7%
No. 40	18.40	6.7%	0.425	93.0%
No. 100	60.25	22.0%	0.15	70.9%
No. 200	33.27	12.2%	0.075	58.7%
Pan	0.94	0.3%		
Total	113.73	41.6%		

Sieve Analysis



Proctor Test Report
Cumberland Landfill
DAA# 18020117-030102
Prepared By: CBW

 **Draper Aden Associates**
Engineering • Surveying • Environmental Services
 1030 Wilmer Ave., Ste. 100
 Richmond, VA 23227
Army Corps of Engineers Certified Laboratory

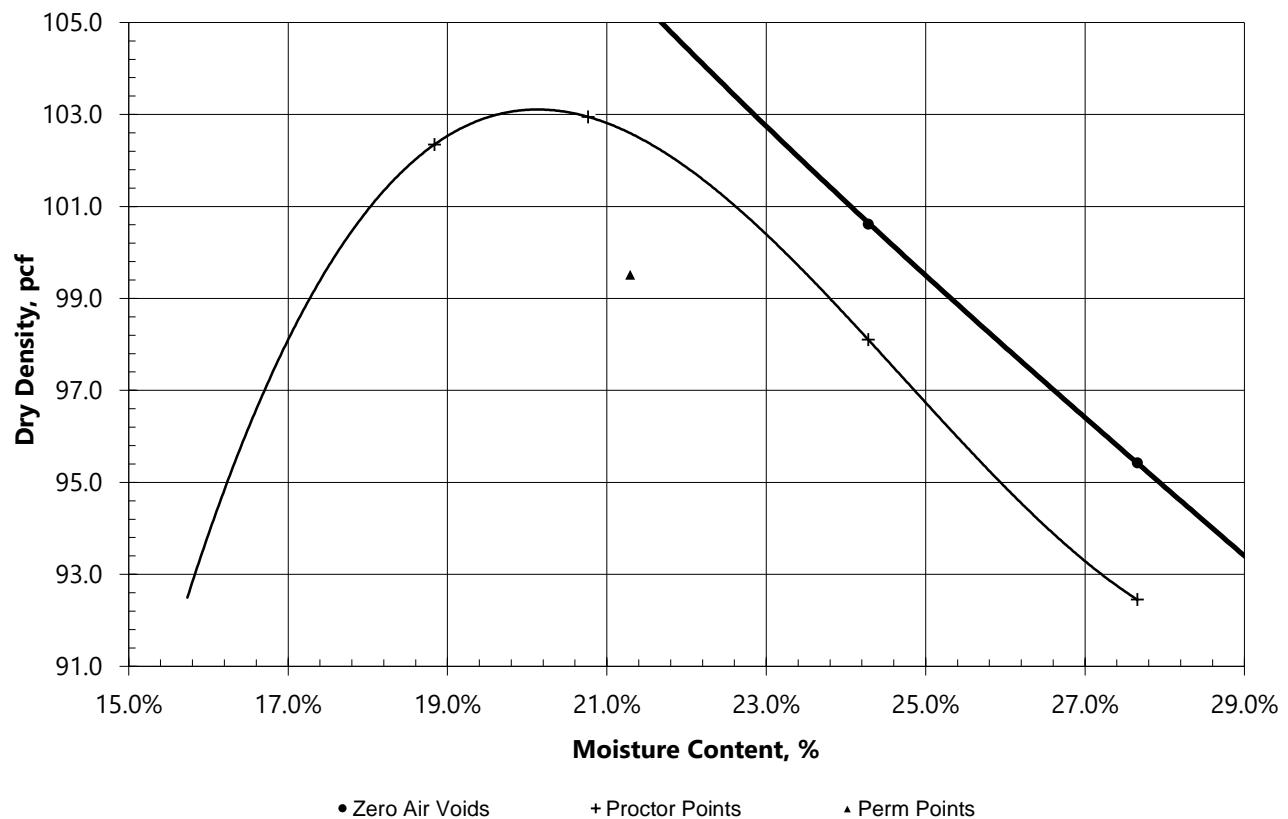
Soil and Test Method Data

Sample ID West	Sample Recieved: 4/11/2019
Sample Depth 2.5'-5'	Date Tested: 4/18/2019
Sample Classification Sandy Fat CLAY	
USCS Group Symbol CH	
Test Method ASTM D698, Method B, with mechanical hammer	
Sample Preparation Air dried and sieved through a 3/8" sieve.	
Mold Size, in 4.0	
Assumed Specific Gravity: 2.65	

Test Data	#1	#2	#3	#4	#5
Moisture Content	18.8%	20.8%	24.3%	27.7%	
Dry Density, pcf	102.3	102.9	98.1	92.5	

Moisture-Density Curve

Maximum Dry Density, pcf = 103.2 , Optimum Moisture, % = 20.1



Permeability Calculations

Cumberland Landfill

DAA# 18020117-030102

Prepared By: CBW

Sample ID: West
 Sample Depth: 2.5'-5'
 Permeability Method: ASTM D5084
 Sample Length, in: 3.64
 Sample Diameter, in: 2.86
 Sample Condition: Remolded

Sample Received: 4/11/2019
 Date Tested: 5/2/2019

Moisture Content

Pan Wt 6.65 grams
 Pan + Soil (wet) 241.12 grams
 Pan + Soil (dry) 199.96 grams
 Moisture Content 21.3%

Dry Density

Soil (wet) 741.01 grams
 Wet Density 120.7 pcf
 Dry Density 99.5 pcf

Test Conditions

Backpressure, psi 40.0
 Cell Pressure, psi 50.0
 Influent Buret Area, cm² 0.03142
 Effluent Buret Area, cm² 0.76712
 Effective Stress, psi 10.0
 Pearment Liquid Temp.(°C):

De-aired Water

Initial Data

Assumed Specific Gravity 2.65
 Percent Voids 39.8%
 Actual Volume of Voids 152.6 ml
 Porosity 39.8%
 Saturation 85.2%

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm ³	Effluent Head, cm	Effluent Flow, cm ³	Flow Deviation Ratio	Gradient mm-Hg	Permeability, k cm/sec
7-May 8:45	15.500		1.600				
7-May 8:46	14.900	0.019	1.625	0.019	1.00	18.87	4.1E-07
7-May 8:47	14.700	0.006	1.633	0.006	1.00	18.02	1.4E-07
7-May 8:48	14.600	0.003	1.637	0.003	1.00	17.74	7.2E-08
7-May 8:49	14.500	0.003	1.641	0.003	1.00	17.60	7.2E-08
7-May 8:50	14.400	0.003	1.645	0.003	1.00	17.45	7.3E-08
7-May 8:51	14.300	0.003	1.649	0.003	1.00	17.31	7.3E-08
7-May 8:52	14.200	0.003	1.653	0.003	1.00	17.17	7.4E-08
7-May 8:53	14.100	0.003	1.657	0.003	1.00	17.03	7.4E-08
7-May 8:58	13.700	0.013	1.674	0.013	1.00	16.89	6.1E-08

Average Permeability

7.1E-08 cm/sec

Corrected for 20°C

Final Data

Assumed Specific Gravity 2.65
 Final Weight of Sample 761.99 grams
 Final Moisture Content 24.7%
 Percent Voids 39.6%
 Actual Volume of Voids 151.1 ml
 Porosity 39.6%
 Saturation 100.0%

Final Sample Length, in: 3.60
 Final Sample Diameter, in: 2.87
 Wet Density 124.6 pcf
 Dry Density 99.9 pcf

ATTACHMENT PTA-XIV - MATERIALS VOLUME CALCULATIONS

As required by §9 VAC 20-81-460.E.2.b.(3), calculations supporting the estimate of soil materials required for development and operation of the landfill are provided as Attachment XIV. On-site soil materials will be used for structural fill, bedding layers, upper layers of closure cap, intermediate cover and some operations. On-site soils will not be used for liner or the infiltration layer component of the cap. A geosynthetic clay liner will be used in place of clay soil materials. Green Ridge plans to use alternate daily covers in lieu of the 6 inches of soil, where appropriate.

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) was issued on April 8, 2021. No comments were received on Attachment PTA-XIV under TR 1. Responses on TR 1 were provided to DEQ on October 1, 2021 to address comments 1 – 10, 12 -13 and 17 – 22. A TR 1 Supplemental response was provided to DEQ on April 13, 2022 to address comments 11, and 14-16.

DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 with an addendum to TR 2 issued on October 25, 2022. No comments specific to this attachment were received.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this attachment.

Under TR 1 Supplement the conceptual base grades were modified, raising the elevation at the northern end, which decreased the potential excavation depth in that area. New calculations for the estimated soil materials for landfill development and operation were provided with the May 12, 2023 submittal and are included in this Final Part A Submission.

Note that the calculations indicate a slight deficit of 84,000 cubic yards. This would be equivalent to approximately 10 acres of borrow at an average depth of 5 feet. Given the additional acreage on the site and the adjacent properties owned by Green Ridge, this deficit should be readily addressed within the facility boundary or from other properties under control of the applicant.

This attachment is submitted as part of the Final Part A Submission. The following is a list of documents associated with this attachment:

- Table - Material Balance Calculations – 8:1 Waste to Soil; Estimated Maximum Operational Area - Conceptual

Green Ridge Recycling and Disposal Facility, LLC					
Material Balance Calculations - 8:1 Waste to Soil					
Estimated Maximum Operational Area - Conceptual					
Final Part A Submission; August 2023					
Assumptions:					
Area(acres)		240	Rounded		
Available soil resource (cy)		4,800,000	Estimated	TR 1 Supplement base grade	
Conceptual airspace (cy)		54,000,000	Estimated	Maximum	
On-site borrow areas					
Area (acres)		180	Estimated borrow		
Depth of excavation (ft)		15	Average		
Available soil resource (cy)		4,356,000	Estimated borrow		
MATERIAL USAGE	THICKNESS OF LAYER (ft)	MAX. OPERATIONAL AREA EXCAVATION	ON-SITE BORROW AREAS	TOTALS	COMMENTS
Available soil material		4,800,000	4,356,000	9,156,000	
Engineered uses					
Perimeter road fill (TR 1 concept)	Varies	1,191,000	0	1,191,000	Fill for perimeter road and berm
Structural fill (other)	Varies	500,000			Estimated - no design parameters
Low permeability soil liner material	2.0	0	0	0	Will use GCL instead of 24" clay
Liner bedding layer	0.5	193,600	0	193,600	
Interim cover	1.0	387,200	0	387,200	
Infiltration layer	1.5	0	0	0	Will use GCL instead of 18" clay
Cap bedding layer	0.5	193,600	0	193,600	
Erosion layer	1.5	580,800	0	580,800	
Vegetative layer	0.5	193,600	0	193,600	
SUBTOTAL		3,239,800	0	3,239,800	
Operations (intermediate cover, others)		6,000,000	0	6,000,000	Waste to soil ratio 8:1
TOTAL Soil Required		9,239,800	0	9,239,800	
Soil Balance		-4,439,800	4,356,000	-83,800	Can borrow from other areas within the site or from adjacent properties under ownership

PTA ATTACHMENT XV - GEOLOGIC MAPS, ORTHOGONAL CROSS-SECTIONS, POTENTIOMETRIC SURFACE MAPS, and BEDROCK SURFACE MAP

The Part A Application was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) was issued on April 8, 2021. TR 1 included comments on this Attachment. Responses on TR 1 were provided to DEQ on October 1, 2021 and April 13, 2022 (Supplement). In order to respond to TR 1, two additional borings were completed, DAA-101pz and DAA-112pz.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022 and an addendum to TR 2 issued on October 25, 2022. Neither of these technical reviews provided any comments on the documents in this attachment.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. One minor comment on the cross-sections was received.

PTA ATTACHMENT XV has been updated with the information from the additional borings and other TR-1 items and as required by the June 29, 2023 comment.

This Attachment updates the document to incorporate TR 1 information and TR 1 Supplement information, as appropriate. It is submitted as the Final Part A Submission.

Geologic Map

A geologic map of the site has been prepared, and is provided as **PTA Attachment XV – Geologic - Map**, as required by §9 VAC 20-81-460.E.2.c.(4). There is no change from the original Part A submittal.

The Green Ridge site is underlain by porphyroblastic biotite gneiss (map symbol bgp), which is described as a light-gray, medium grained segregation-layered gneiss containing prominent potassium feldspar porphyroblasts. The mineralogy includes quartz + biotite + plagioclase + potassium feldspar + muscovite + hornblende. Accessory minerals include epidote, apatite and opaque minerals. It is of Proterozoic age.

Cross Sections

In accordance with §9 VAC 20-81-460.E.2.c.(5), and based on the data collected from the Part A subsurface investigation and additional work completed under TR 1, four orthogonal cross sections of the site have been prepared and are presented as revised **Figure PTA Attachment XV - Cross-1** (also identified as LA-11 under the TR 1 supplement submittal). Cross sections were previously submitted to DEQ on April 13, 2022, as part of our TR 1 Supplemental response. As noted in the

October 1, 2021 TR 1 response, base grades in the original Part A application were incorrect and the drilling of an additional deep boring, DAA-101, was proposed. In addition, several cross sections (A and C as well as an extended Cross Section D) were eliminated as outside of the anticipated disposal unit. The document provided in this PTA Attachment XV replaces all other cross section submittals.

It should be noted that the base grades illustrated on the cross sections are based on an overall disposal unit layout developed during the conceptualization of the Facility and does not represent a final designed facility disposal unit. Future disposal units will be permitted under the Part B process within the approved Waste Management Boundary.

The June 29, 2023 comment email requested that the locations of Pinegrove Road and Miller Lane be shown on the cross section. This has been completed.

Potentiometric Maps

Potentiometric surface maps of the site have been prepared based on measurements collected during May and October 2019, and are provided as **PTA Attachment XV - GW-1 and PTA Attachment XV – GW-2** as required by §9 VAC 20-81-460.E.2.c.(6). After numerous water level measurement events, the May 2019 potentiometric map overall represents the maximum (highest) water level for the Facility. As such, this potentiometric surface was used on the cross section map and for the development of conceptual base grades for the Facility. **PTA Attachment XV-GW 1** was modified and submitted under the TR 1 Supplement April 13, 2022 response. Minor edits were made for the TR 2 response. **PTA Attachment XV – GW-2** for the October 2019 data is the same as previously submitted with the original Part A application, with minor edits for the TR 2 response.

Groundwater elevation data continued to be collected after the original Part A submittal with the data from April 2019 through June 2022 events summarized in Table 1A, provided in **PTA Attachment XI**.

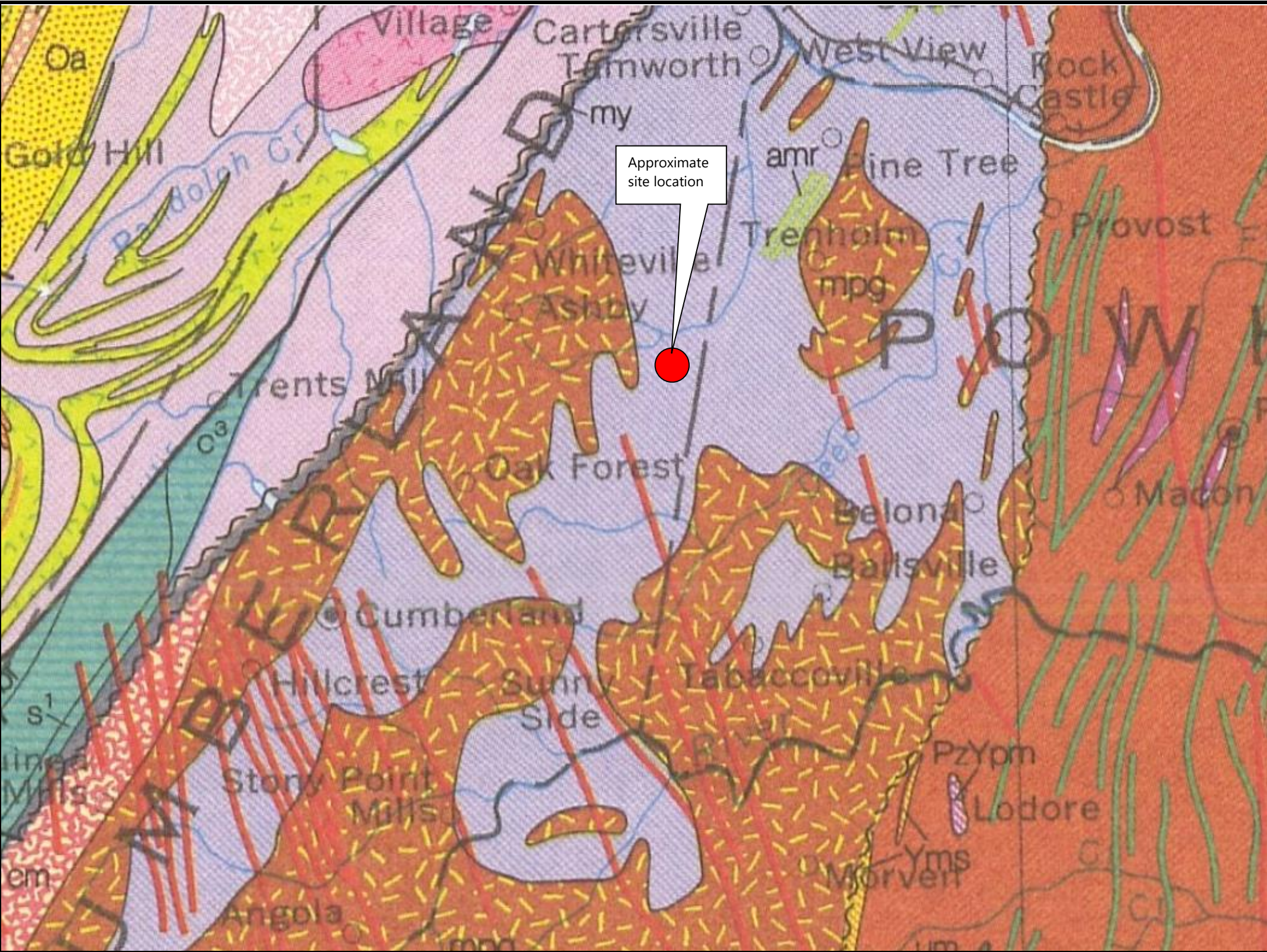
Bedrock Surface Map

A map of the bedrock surface is provided at **PTA Attachment XV-Bed-1**. This shows the configuration of the bedrock surface beneath the site, as it contributes to the overall groundwater flow pattern. This figure was modified and submitted under the TR 1 Supplement April 13, 2022 response. The TR 2 response incorporates the TR 1 Supplement information into the original PTA Attachment XV-Bed-1 mapping. To bring consistency among the various drawings, streams, boundaries, road networks etc. have also been updated.

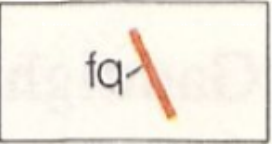
The following is a list of documents associated with this section:

PTA Attachment XV – Geologic Map – Dated December 3, 2019 (Original Part A)
PTA Attachment XV – Figure: Cross-1 - Updated Cross Sections B, D, E, and F Dated August 3, 2023
PTA Attachment XV – Figure: GW-1 - Potentiometric Surface map – May 2019 Dated August 3, 2023
PTA Attachment XV – Figure: GW-2 - Potentiometric Surface Map – Oct 2019 Dated August 3, 2023

PTA Attachment XV – Figure: BED - Bedrock Surface Map Dated August 3, 2023



Geologic Legend



Ferruginous Quartzite: Heterogenous layered assemblage correlates with the Chopawamsic Formation and Ta River Metamorphic Suite, on strike to the northeast and traceable into the Milton belt in North Carolina (Geologic Map of North Carolina, 1985). Cambrian Age.



Porphyroblastic Biotite Gneiss: Light-gray, medium grained, segregation-layered gneiss, contains prominent potassium feldspar porphyroblasts. Mineralogy: quartz + biotite + plagioclase + potassium feldspar + muscovite + hornblende; accessory minerals include epidote, apatite and opaque minerals. Proterozoic age.



Migmatic Paragneiss: Leucocratic to mesocratic, medium- to coarse-grained layered gneiss contains interlayered biotite-rich and quartzofeldspathic zones, locally magmatic; includes lesser amounts of biotite schist, muscovite schist, and thin lenticular amphibolite bodies. Mineralogy: biotite + muscovite + plagioclase + potassium feldspar + garnet + hornblende. Proterozoic age

Green Ridge Recycling and Disposal Facility - Geological Map

Location: Cumberland County, Virginia
Project: Part A Permit Application

Project No. 18020117-030102

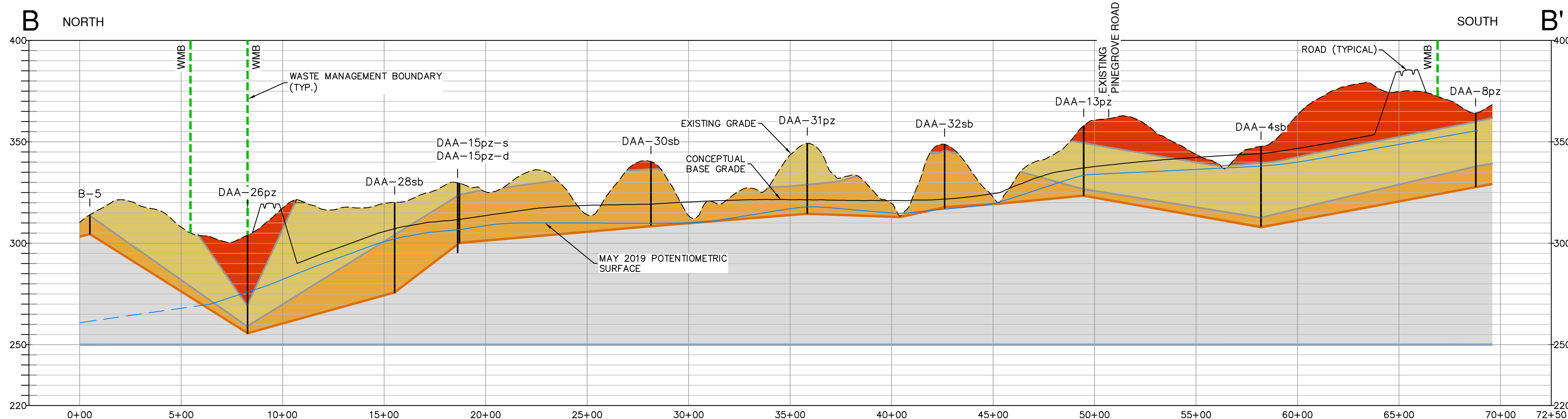


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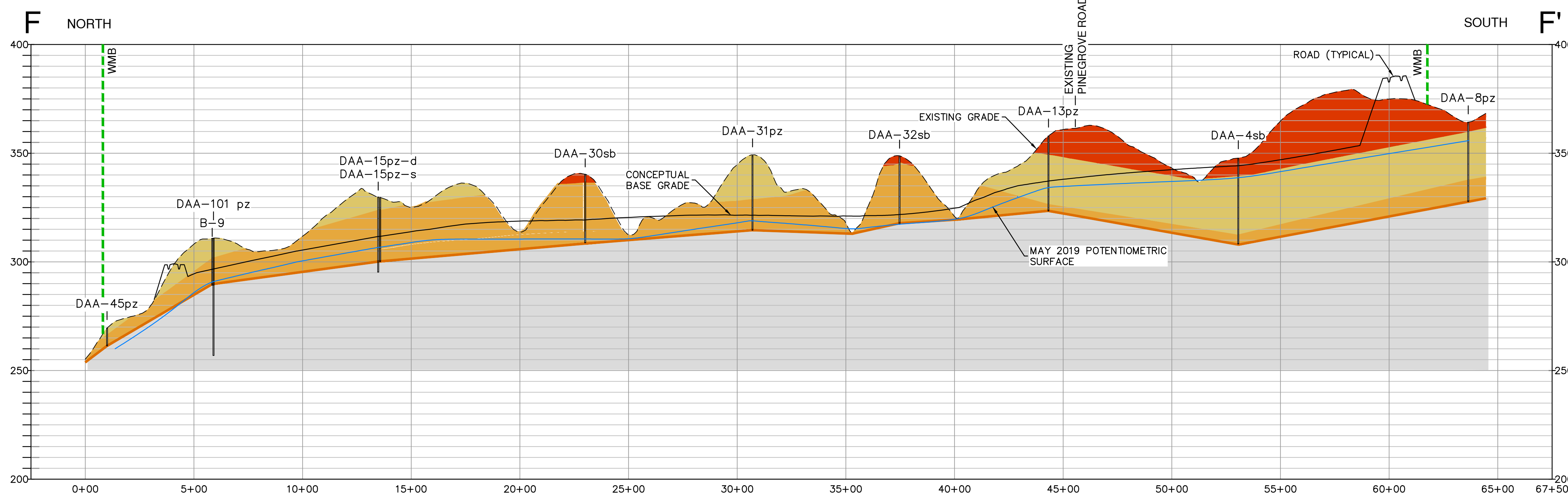
DESIGNED: BHH
DRAWN: BHH
CHECKED: DC
DATE: 12-03-19

SOURCE: USGS Geologic Map of Virginia, 1993
Scale 1:500,000

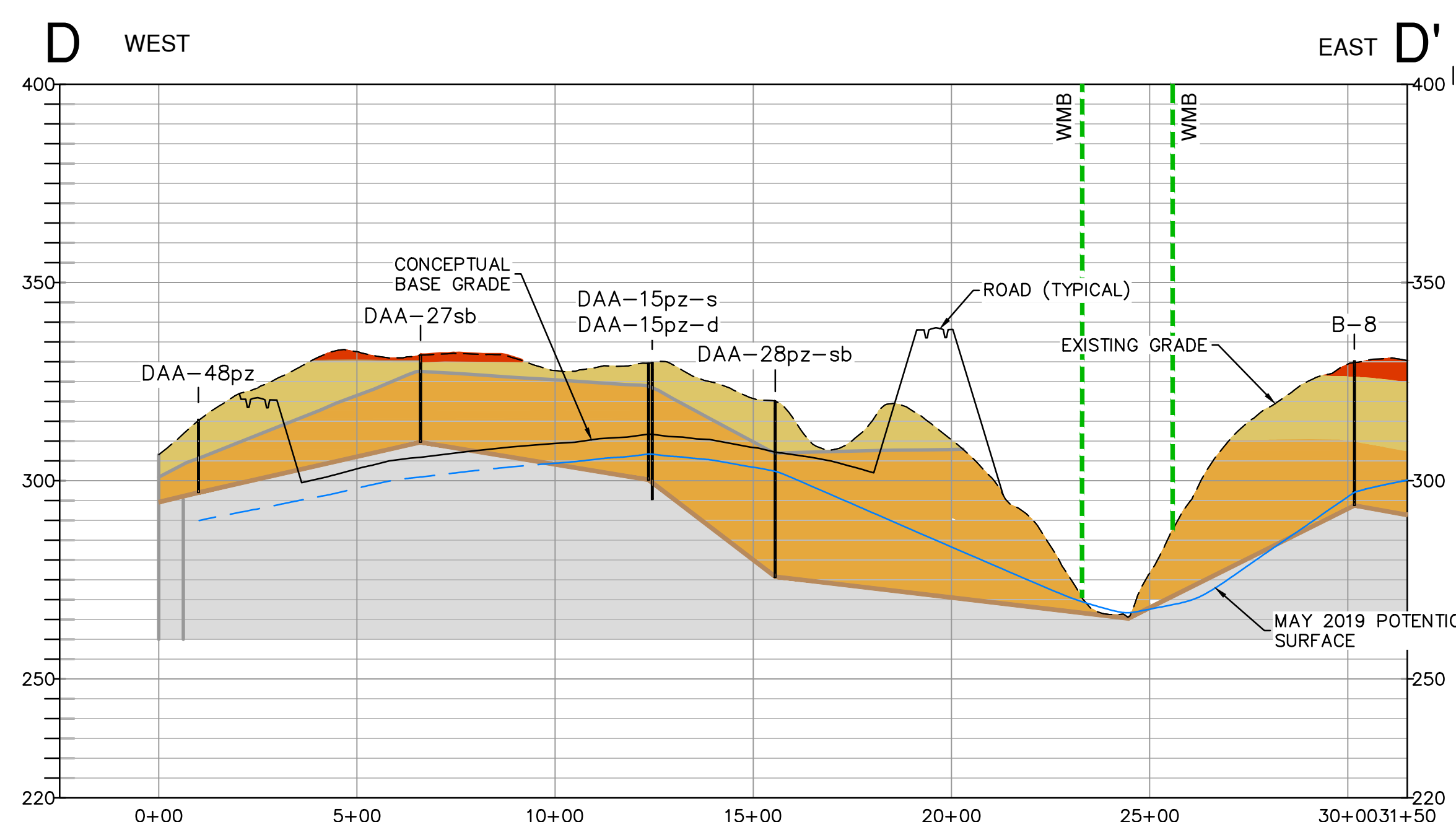
FIGURE
PTA Attachment XV – Geologic Map



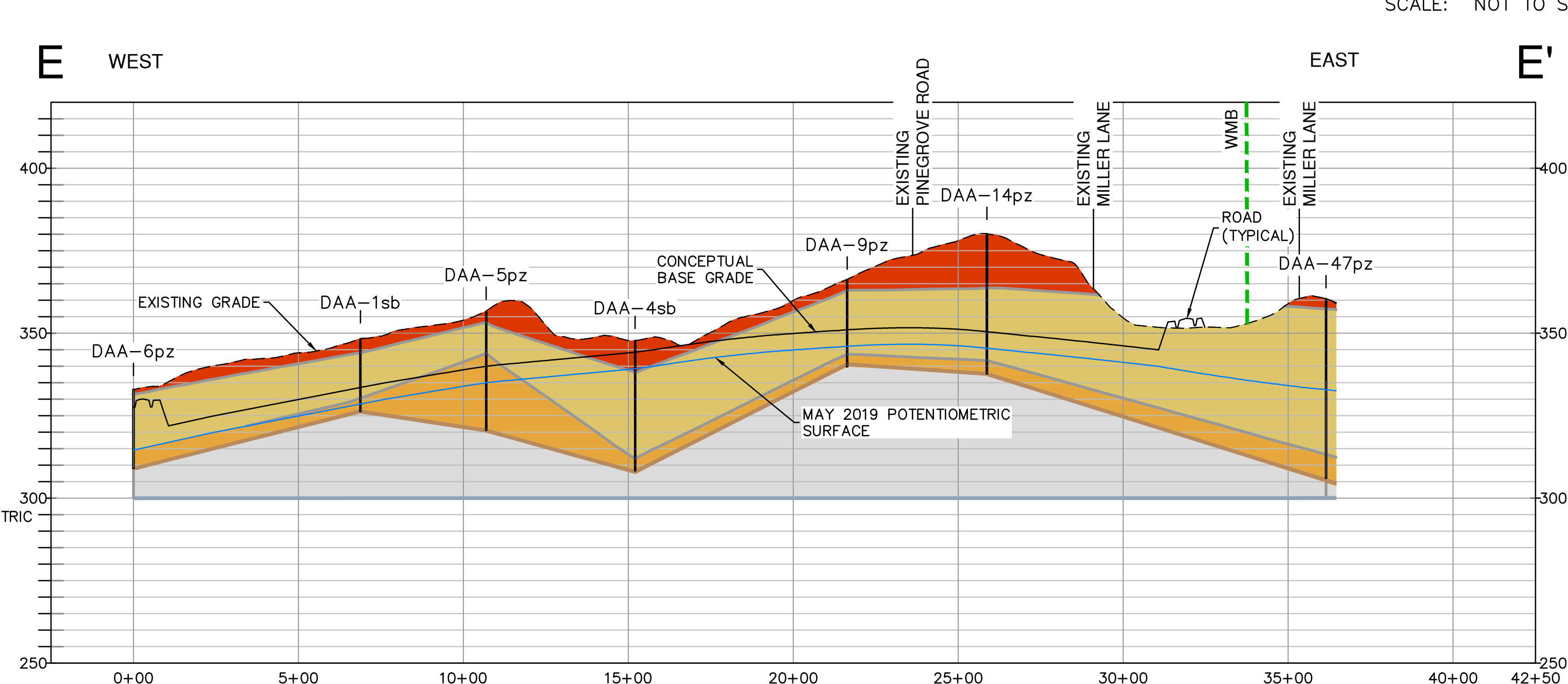
SECTION B-B' — Scale: H: 1"=300', V: 10:1



SECTION F-F' - Scale: H: 1"=300', V: 10:1

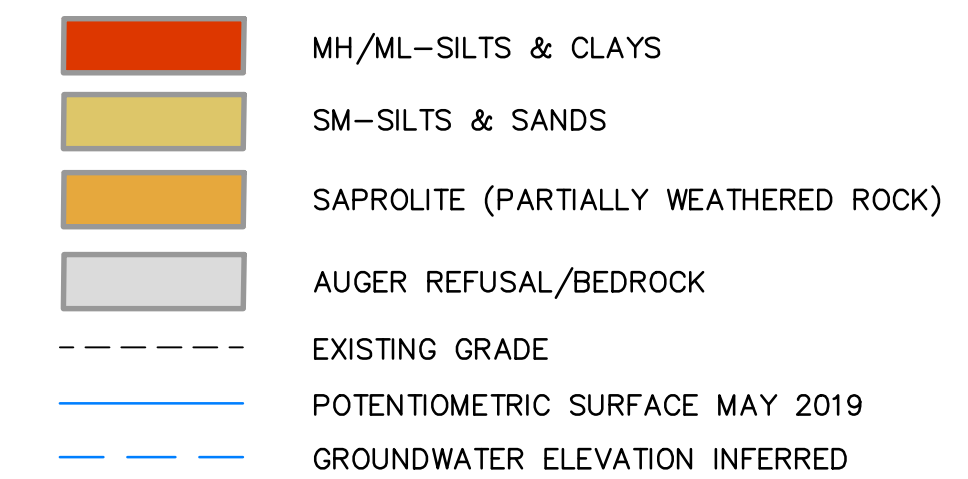


SECTION D-D' — Scale: H: 1"=300', V: 10:1



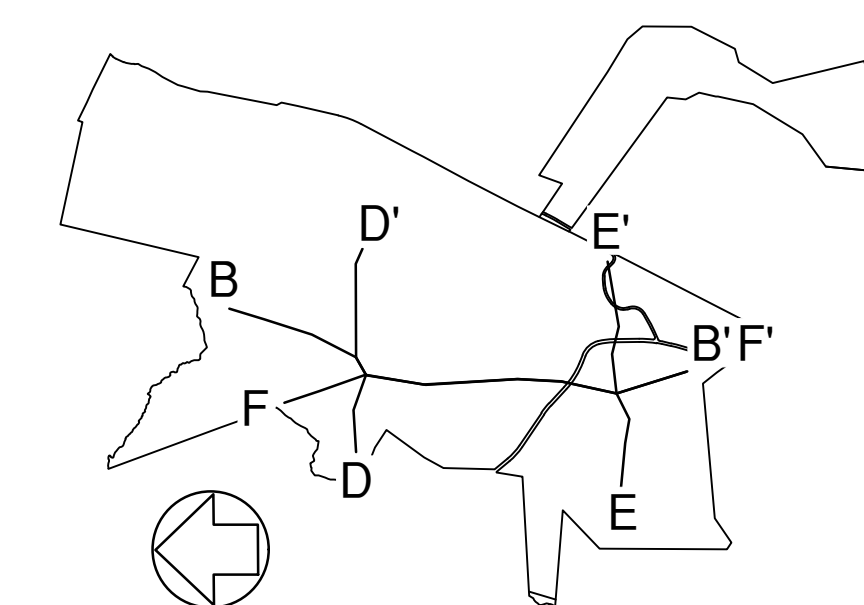
SECTION E-E' - Scale: H: 1"=300', V: 10:1

LEGEND:



NOTES:

1. Cross Sections A and C have been removed from documentation since not located within Waste Management Boundary.
2. Groundwater elevation data from new piezometer DAA-101pz was collected in December 2021 and incorporated into May 2019 potentiometric surface contours.



KEY MAP

SCALE: NOT TO SCALE

A circular professional seal for Michael David Lawless, a Certified Professional Geologist in the Commonwealth of Virginia. The seal features a scalloped outer border. Inside the border, the text "COMMONWEALTH OF VIRGINIA" is arched across the top, and "CERTIFIED PROFESSIONAL GEOLOGIST" is arched across the bottom. In the center, there is a stylized signature of "MDL". Below the signature, the text "MICHAEL DAVID LAWLESS" is printed in a bold, sans-serif font. Underneath the name, "No. 832" is printed, followed by the expiration date "August 03, 2023".

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- Hampton Roads, VA
- Raleigh, NC
- Fayetteville, NC
- Northern Virginia
- Virginia Beach, VA



UPDATED CROSS SECTIONS B, D, E, AND F

**GREEN RIDGE RECYCLING
AND DISPOSAL FACILITY**

CUMBERLAND COUNTY, VIRGINIA

REVISIONS

TR-1 Response:
October 01, 2021

TR-1 Supplement Response:
April 12, 2022

TR-2 Response:
May 12, 2023 , Minor
Updates to TR-1 Supplement
Response

Final Part A, Added existing
roads, 08/03/2023

DESIGNED BY: DC

DRAWN BY: DLD / D

CHECKED BY:
KEB / W

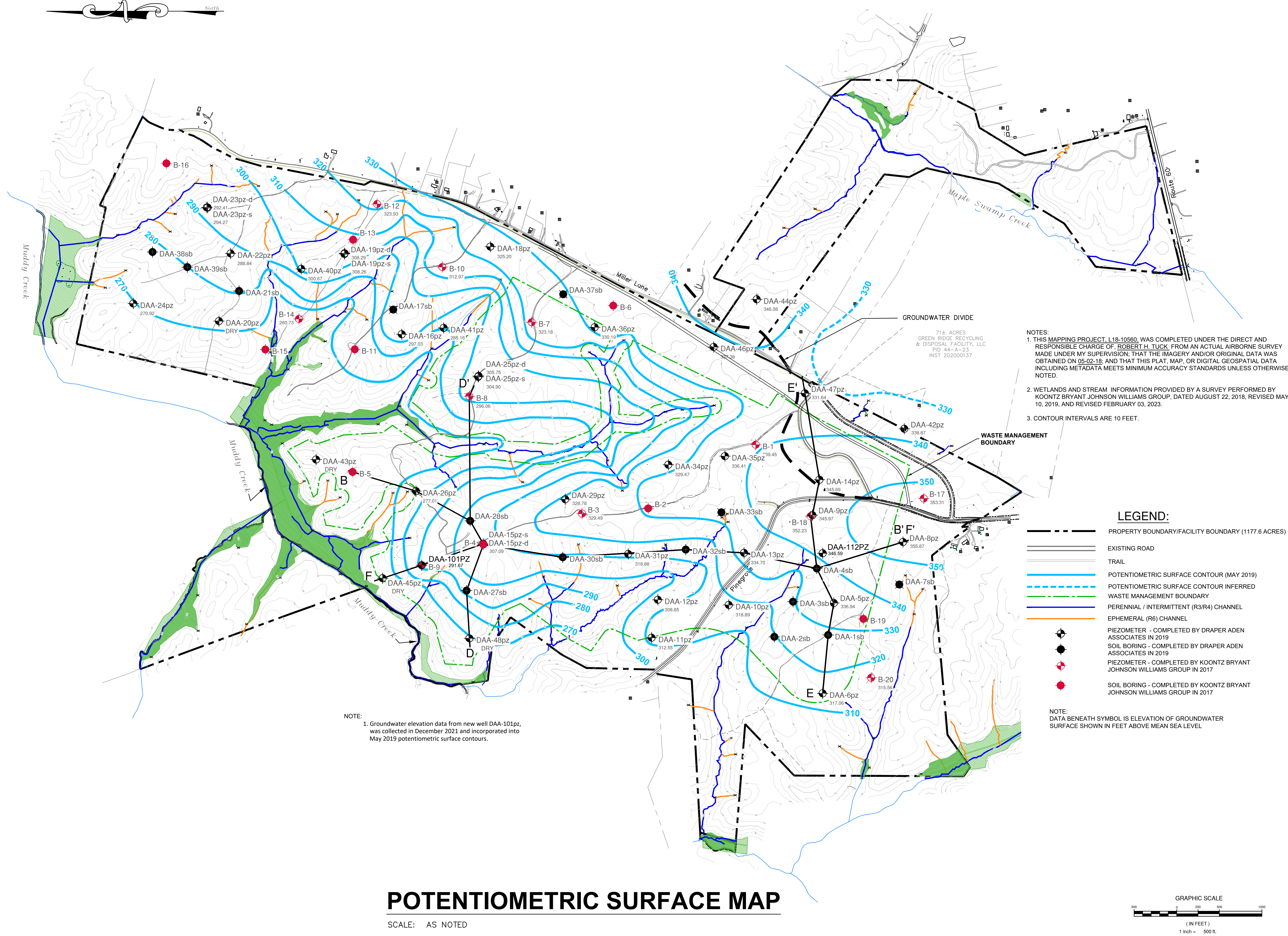
SCALE: AS NOT

DATE: 08/03/20

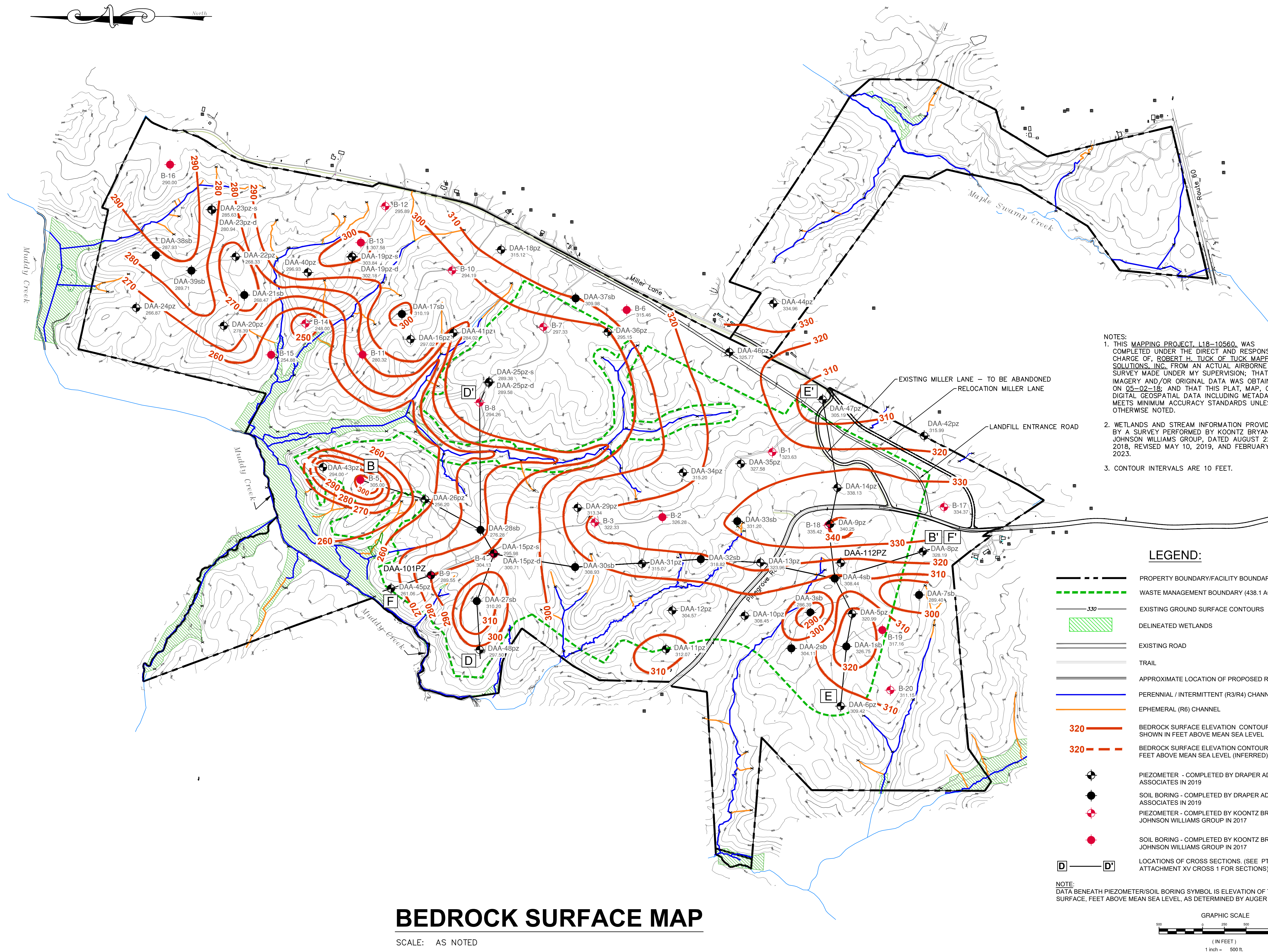
PROJECT NUMBER:
10000117

18020117-090102
DTA ATTACHEMENT YV

PTA ATTACHMENT XV
FIGURE: CROSS-1



POTENTIOMETRIC SURFACE MAP



BEDROCK SURFACE MAP

NOTES:

1. THIS MAPPING PROJECT, L18-10560, WAS COMPLETED UNDER THE DIRECT AND RESPONSIBLE CHARGE OF, ROBERT H. TUCK OF TUCK MAPPING SOLUTIONS, INC. FROM AN ACTUAL AIRBORNE SURVEY MADE UNDER MY SUPERVISION; THAT THE IMAGERY AND/OR ORIGINAL DATA WAS OBTAINED ON 05-02-18; AND THAT THIS PLAT, MAP, OR DIGITAL GEOSPATIAL DATA INCLUDING METADATA MEETS MINIMUM ACCURACY STANDARDS UNLESS OTHERWISE NOTED.

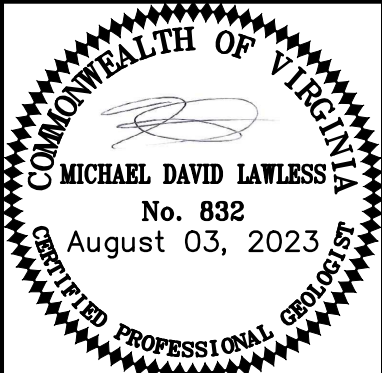
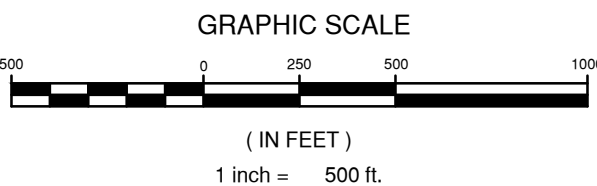
2. WETLANDS AND STREAM INFORMATION PROVIDED BY A SURVEY PERFORMED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP, DATED AUGUST 22, 2018, REVISED MAY 10, 2019, AND FEBRUARY 03, 2023.


3. CONTOUR INTERVALS ARE 10 FEET.

LEGEND:

- | | |
|--|---|
| | PROPERTY BOUNDARY/FACILITY BOUNDARY (1177.6 ACRES) |
| | WASTE MANAGEMENT BOUNDARY (438.1 ACRES) |
| | EXISTING GROUND SURFACE CONTOURS |
| | DELINEATED WETLANDS |
| | EXISTING ROAD |
| | TRAIL |
| | APPROXIMATE LOCATION OF PROPOSED ROAD |
| | PERENNIAL / INTERMITTENT (R3/R4) CHANNEL |
| | EPHEMERAL (R6) CHANNEL |
| | BEDROCK SURFACE ELEVATION CONTOUR SHOWN IN FEET ABOVE MEAN SEA LEVEL |
| | BEDROCK SURFACE ELEVATION CONTOUR SHOWN IN FEET ABOVE MEAN SEA LEVEL (INFERRED) |
| | PIEZOMETER - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019 |
| | SOIL BORING - COMPLETED BY DRAPER ADEN ASSOCIATES IN 2019 |
| | PIEZOMETER - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017 |
| | SOIL BORING - COMPLETED BY KOONTZ BRYANT JOHNSON WILLIAMS GROUP IN 2017 |
| | LOCATIONS OF CROSS SECTIONS. (SEE PTA ATTACHMENT XV CROSS 1 FOR SECTIONS). |

NOTE:
DATA BENEATH PIEZOMETER/SOIL BORING SYMBOL IS ELEVATION OF TOP OF BEDROCK SURFACE, FEET ABOVE MEAN SEA LEVEL, AS DETERMINED BY AUGER REFUSAL.



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- Virginia Beach, VA



BEDROCK SURFACE MAP

GREEN RIDGE RECYCLING
AND DISPOSAL FACILITY

CUMBERLAND COUNTY, VIRGINIA

REVISIONS

TR-1 Supplement Response
April 12, 2022

TR-2 Response
May 12, 2023 Minor updates
to TR-1 Supplement
Response

Final Part A, updated
certification and dates,
08/03/2023

DESIGNED BY:	DC
DRAWN BY:	DLD/DJF
CHECKED BY:	KEB
SCALE:	1" = 500'
DATE:	08/03/2023
PROJECT NUMBER:	18020117-090102
PTA ATTACHMENT XV FIGURE: BED	

ATTACHMENT PTA-XXIII - PROXIMITY TO GEOLOGIC HAZARDS OR SEISMIC ZONES

In accordance with *Virginia Solid Waste Management Regulations (VSWMR)* 9VAC20-81-120 - Siting Requirements, subsection 9VAC20-81-120.B.2, a municipal solid waste landfill may not be sited where on-site or local geological or man-made features or events may result in sudden or non-sudden events and subsequent failure of structural components or containment structures.

The Part A Application including this attachment was originally submitted to DEQ on January 22, 2020. It was reviewed by DEQ and Technical Review No. 1 (TR 1) issued by DEQ on April 8, 2021. TR 1 had 22 comments with three of the comments (Comments 14, 15 and 16) specifically related to seismic zones and design (i.e., Ground Shaking Hazard Levels and Landfill Containment Structure Design Considerations) as follows:

- 14.) *The proposed landfill is located within the Central Virginia Seismic Zone. 9 VAC 20-81-120.C.3.b.(1) restricts siting of a landfill within a seismic impact zone unless the owner or operator demonstrates that all containment structures are designed to resist the maximum horizontal acceleration in lithified earth material for the site. Attachment XXIII indicates that the peak ground acceleration may be as much as 20% gravity for the landfill site. However, according to the USGS Unified Hazard Tool, the peak ground acceleration to be used for design purposes at this site location is 22.5% gravity, or 0.225g. Please note that the USGS updated the U.S. Seismic Hazard Long-Term Model in 2018. The applicant should use the updated data as appropriate in the Part A Permit Application.*
- 15.) *The proposed base grades depicted in Attachment XV of the Part A Permit Application are shown constructed into the bedrock in some areas, and atop as much as 35 feet of silts and sands in other areas of the site. Attachment XXIII indicates that the proposed landfill will incorporate a design seismic coefficient of 0.10g, or one-half the peak ground acceleration. However, it is not appropriate to set the seismic coefficient as one-half the peak bedrock acceleration at this stage, since the seismic coefficient is related to the peak acceleration at the ground surface, which may be amplified by the overlying soils and be different than the peak acceleration in bedrock.*
- 16.) *An assessment of the Liquefaction Potential should be performed based upon the geotechnical and hydrogeological data gathered from the site investigations (in particular in those areas with more extensive silts and sands, e.g., DAA-4sb and DAA-36pz). In addition, a preliminary seismic stability analysis should be performed for both conditions that may be present (i.e., landfill constructed into bedrock, and landfill constructed atop 35 feet or more of silts and sands), in order to demonstrate that the landfill can be designed to resist the maximum horizontal acceleration in bedrock, as required by 9 VAC 20-81-120.C.3.b.(2). Guidance for*

performing these assessments can be found in document EPA/600/R-95/051, RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities.

Green Ridge's responses to the TR 1 comments were addressed in two phases:

- Phase 1 was a response to all comments although the responses to Comment 11 (deep boring into bedrock), and Comments 14, 15, and 16 indicated that additional field work with technical evaluation was necessary to provide the requested information. In support of this effort, the response indicated that Schnabel Engineering had been retained by Green Ridge to address Comments 14 through 16. The Phase 1 response was submitted to DEQ on October 1, 2021 and included Letter Attachment 12 which contained a preliminary memorandum from Schnabel Engineering dated August 26, 2021.
- Phase 2 was submitted on April 13, 2022 as a supplement to the October 1, 2021 submittal and provided the results of the required additional field investigations and technical evaluation. Key to this submittal was a final report by Schnabel Engineering dated April 8, 2022, which fully addressed responses to Comments 14 through 16 and which superseded the preliminary memorandum included in Letter Attachment 12 of the first TR 1 submittal.

Subsequently, DEQ issued Technical Review No. 2 (TR 2) on June 16, 2022, with a supplement to TR 2 issued on October 25, 2022. No comments specific to this attachment were received.

On May 12, 2023, a draft TR 2 response addressing updates to the Part A documents was submitted by TRC to DEQ for review and comment. Comments were received from DEQ via email on June 29, 2023. No comments were received on this attachment.

The following discussion includes information previously provided with the original Part A, outlines Comments 14 through 16 from TR 1, and references the TR 1 supplement response.

DISCUSSION

In accordance with *Virginia Solid Waste Management Regulations (VSWMR)* 9VAC20-81-120 - Siting Requirements, *VSWMR* 9VAC20-81-120.C.3.B.1 and 9VAC20-81-120.C.3.B.2) provide siting criteria regarding geologic faults and seismic impact zones:

- (1) Within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator demonstrates to the director that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of the facility and will be protective of human health and the environment; or

(2) Within seismic impact zones, unless the owner or operator demonstrates to the director that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

The following discussion addresses the siting criteria for young faults and seismic impact zones.

Ground Displacement by Young Geologic Faults

VSWMR 9VAC20-81-120.C.3.b(1) restricts siting of landfills within 200 feet of a geologic fault that demonstrated movement within the Holocene epoch (i.e., young faults). The Holocene epoch spans from 11.7 thousand years ago to today, and is part of the Quaternary Period. The Quaternary Period is divided into two epochs: the earlier Pleistocene (2.588 million years ago to 11.7 thousand years ago) and the later Holocene (11.7 thousand years to today).

The U.S. Geological Survey (USGS) documented faults or fault-related features in the United States with movement known or suspected to have occurred in the Quaternary (USGS, 2006). This resource presents a conservative assessment of the potential for young faults to be present within 200 feet of the proposed landfill and related containment features, because it increases the criteria for fault identification from the Holocene (11,700 years ago) to the entire Quaternary (2,588,000 years ago).

Table PTA-XXIII-1, below, summarizes the USGS assessment of known or potential Quaternary faults in the region surrounding the proposed Facility (USGS, 2006). **Figure PTA-XXIII-1** illustrates the proposed landfill location and the approximate location of the potential fault or fault-like features identified by USGS (2006).

Table PTA-XXIII-1	
Summary of Known or Inferred Quaternary age Faults or Fault-like Features (USGS, 2006). See Figure PTA-XXIII-1 for Referenced # Feature Location	
1	<p>Feature Identity: Central Virginia seismic zone</p> <p>CEUS Class (see note): A</p> <p>Description: Moderate level of diffuse seismicity. 5.8 M earthquake occurred on August 23, 2011. Hypocenter was in Louisa County, 5 miles SSW of Mineral and 37 miles NW of Richmond. Thought to be of tectonic origin with liquefaction fields caused by moderate to large historical and Holocene earthquakes.</p>

2	<p>Feature Identity: Pembroke faults</p> <p>CEUS Class (see note): B</p> <p>Description: Small, normal faults with up to 11 m displacement. Non-tectonic origin. Fault trace fillings contain delicate grain-scale textures precluding sudden slip. Likely caused by dissolution of underlying carbonate bedrock.</p>
3	<p>Feature Identity: Linside fault zone</p> <p>CEUS Class (see note): C</p> <p>Description: Located on northwest edge of the Giles County Seismic Zone (see earlier discussion). Normal fault zone displacing Devonian folded bedrock. No Quaternary movement of the fault zone is demonstrated.</p>
4	<p>Feature Identity: Everona fault – Mountain Run fault zone</p> <p>CEUS Class (see note): C</p> <p>Description: Faults appear to have reactivated with Mesozoic extension of the Culpeper Basin. Quaternary age movement has not been demonstrated for the fault zone.</p>
5	<p>Feature Identity: Lebanon Church fault</p> <p>CEUS Class (see note): C</p> <p>Description: Reverse fault offsets base of gravels overlying Precambrian bedrock. No Quaternary movement of the fault is demonstrated.</p>
6	<p>Feature Identity: Old Hickory faults</p> <p>CEUS Class (see note): C</p> <p>Description: Small reverse faults with up to 6 m of throw placing Coastal Plain gravels over Paleozoic metamorphic bedrock. Faulting was coeval with deposition of faulted Coastal Plain sediment of Pliocene age. No Quaternary movement of the fault zone is demonstrated.</p>
7	<p>Feature Identity: Stanleytown – Villa Heights faults</p> <p>CEUS Class (see note): C</p> <p>Description: Both faults are short (<300 m) with steep dip and <6 m slip. Both faults appear to be related to landslides.</p>

Table PTA-XXIII-1 Notes on CEUS feature class designation (USGS, 2006):

- Class A fault = Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features.
- Class B fault = Geologic evidence demonstrates the existence of a fault or suggests Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.
- Class C fault = Geologic evidence is insufficient to demonstrate (1) the existence of tectonic fault, or (2) Quaternary slip or deformation associated with the feature.

As illustrated in Figure PTA-XXIII-1, the closest identified young fault or fault-like feature with possible Quaternary movement is associated with the Central Virginia Seismic Zone (Reference #1 in Table PTA-XXIII-1; CEUS Class A). The center of this zone is located approximately 20 miles from the proposed landfill, which does not contravene the siting criteria under 9VAC20-81-120.C.3.b(1).

In conclusion, the proposed landfill is not located within 200 feet of a geologic fault that demonstrated movement within the Holocene epoch.

Seismic Hazards

VSWMR 9VAC20-81-120.C.3.b(1) restricts siting of landfills within a seismic impact zone unless the owner or operator demonstrates that all containment structures are designed to resist the maximum anticipated seismically-induced horizontal ground acceleration in lithified earth material. Note that the following assessment incorporates potential soil amplification that could increase the horizontal acceleration from deeper lithified earth material. The information presented below to address seismic impact zones is generally consistent with the 1993 (most recently available) Virginia Department of Environmental Quality (VDEQ) Guidance Document LPR-SW-02-1993 for evaluating landfill Part A demonstration requirements.

The USGS updated the 1993 the probabilistic earthquake-induced ground motion model most recently in 2018 (Rezaeian et al, 2021), which was used to identify seismic impact zones and estimate peak horizontal ground acceleration with a 2,500-year recurrence period.

Summary of Seismic Impact Area

The proposed landfill is located within the Central Virginia Seismic Zone, which approximately

corresponds to probabilistic ground acceleration exceeding 0.1-g (10% of gravity) shown in **Figure PTA-XXIII-2**. Probabilistic earthquake-induced ground motion was evaluated for the proposed landfill based on the 2018 update to the National Seismic Hazard Model (Rezaeian et al, 2021).

Ground Shaking Hazard Levels

The original Part A discussion is replaced by the attached Schnabel Engineering report dated April 8, 2022.

Landfill Containment Structure Design Considerations

The original Part A discussion is replaced by the attached Schnabel Engineering report dated April 8, 2022.

Bibliography

- Crone, A. J. and Wheeler, R. L., (2000). Data for Quaternary faults, liquefaction features, and possible tectonic features in the Central and Eastern United States, east of the Rocky Mountain front. U.S. Geological Survey, Open-File Report 00-260.
- Law, R.D., Pope, M.C., Wirgart, R.H., Eriksson, K.A., Robinson, E.S., Sayer, S., Phinney, E.J., Bollinger, G.A., (1994). Geologically recent near-surface faulting and folding in Giles County, southwest Virginia: New exposures of extensional and apparent reverse faults in alluvial sediments between Pembroke and Pearisburg. Proceedings of the Twenty-First Water Reactor Safety Information Meeting. Volume 3, Primary system integrity; Aging research, products and applications; Structural and seismic engineering; Seismology and geology.
- Petersen, M.D., Moschetti, M. P., Powers, P.M., Mueller, C. S., Haller, K. M., Frankel, A. D., Zeng, Y., Rezaeian, S., Harmsen, S. C., Boyd, O. S., Field, N., Chen, R., Chen, R., Rukstales, K. S., Luco, N., Wheeler, R.L., Williams, R. A., and Olsen, A. H., (2014). Documentation for the 2014 Update of the United States National Seismic Hazard Maps. U.S. Geological Survey Open-File Report 2014-1091.
- Rezaeian, S., Powers, P.M., Shumway, A. Petersen, M.D., Luco, N., Frankel, A., Moschetti, M.P., Thompson, E. M., McNamara, D. (2021). The 2018 update of the US National Seismic Hazard Model: Ground motion models in the central and eastern US. Earthquake Spectra (37) 1354-1390.
- USGS, 2006. Quaternary fault and fold database for the United States, accessed Jan 15, 2015, from U.S. Geological Survey web site: <http://earthquakes.usgs.gov/regional/qfaults/>.
- Wheeler, R. L., (2006). Quaternary tectonic faulting in the Eastern United States. Engineering Geology 82 (2006) 165– 186.

The following is a list of documents that are associated with this section:

- Figure XXIII-1 Quaternary Age Fault or Possible Fault Features, Draper Aden Associates, Dated December 9, 2019
- Figure XXIII-2 Seismic Hazards: Probabilistic Peak Ground Acceleration, Draper Aden Associates, Dated March 1, 2023
- Revision 02 – VDEQ Comment Resolution Support – Comments No. 14 through 16, Green Ridge Recycling and Disposal Facility – Part A Permit Application, Cumberland County, Virginia, Schnabel, Dated April 7, 2022.

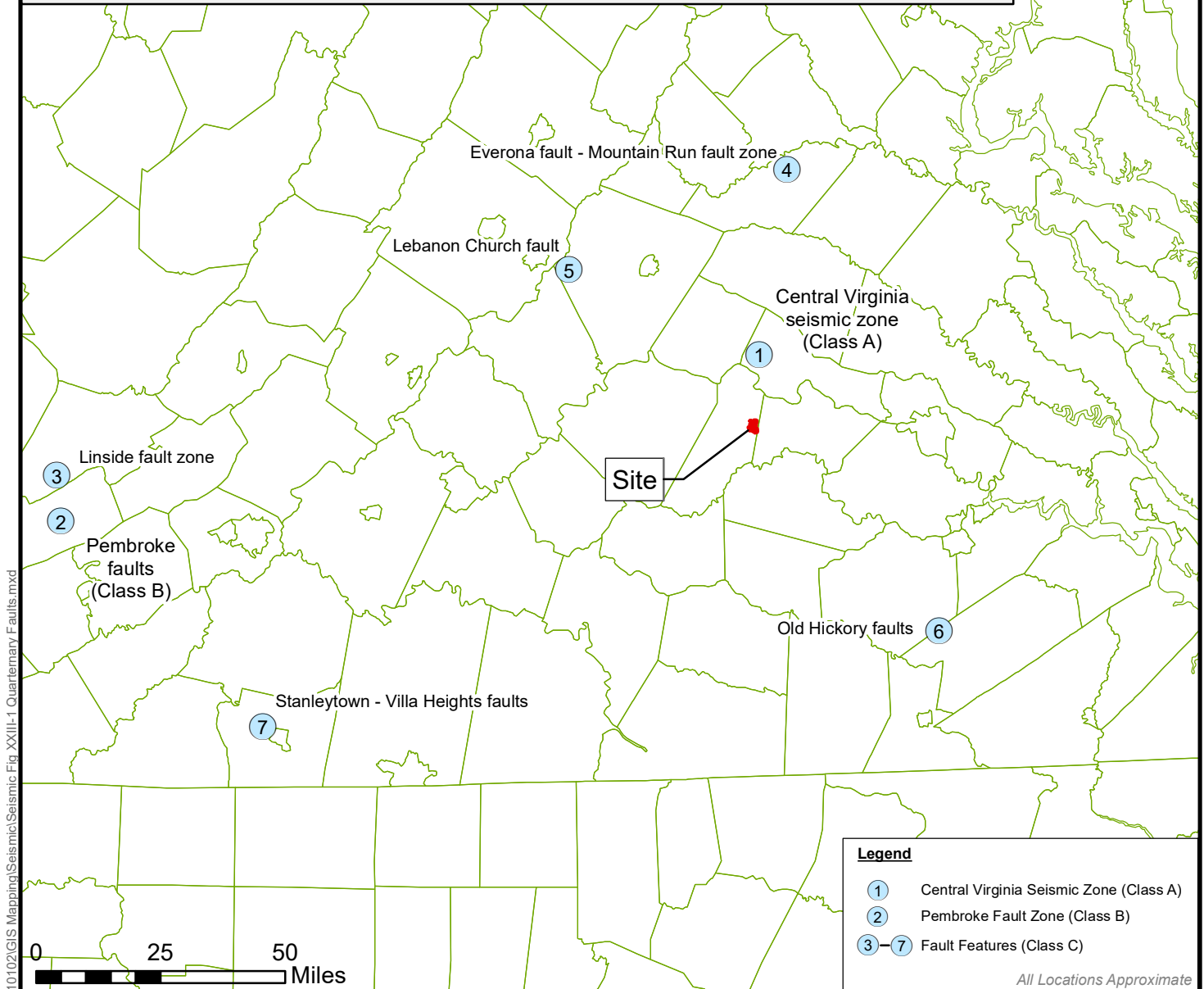
Quaternary Fault Areas

Faults and associated folds in the United States that are believed to be sources of $M > 6$ earthquakes during the Quaternary (the past 1,600,000 years). U.S. Geological Survey, 2006, Quaternary fault and fold database for the United States, accessed Sept 25, 2018, from USGS web site: <http://earthquake.usgs.gov/hazards/qfaults/>.

Crone, A. J. and Wheeler, R. L., (2000). Data for Quaternary faults, liquefaction features, and possible tectonic features in the Central and Eastern United States, east of the Rocky Mountain front. U.S. Geological Survey, Open-File Report 00-260.

Wheeler, R. L., (2006). Quaternary tectonic faulting in the Eastern United States. Engineering Geology 82 (2006) 165– 186.

Law, R.D., et al., (1994). Geologically recent near-surface faulting and folding in Giles County, southwest Virginia: New exposures of extensional and apparent reverse faults in alluvial sediments between Pembroke and Pearisburg. Proceedings of the Twenty-First Water Reactor Safety Information Meeting. Volume 3, Primary system integrity; Aging research, products and applications; Structural and seismic engineering; Seismology and geology.



Quaternary Age Fault or Possible Fault Features

Green Ridge Recycling
and Disposal Facility
Cumberland Co., Virginia

SCALE: 1:2,000,000

PROJECT: 18020117-010102



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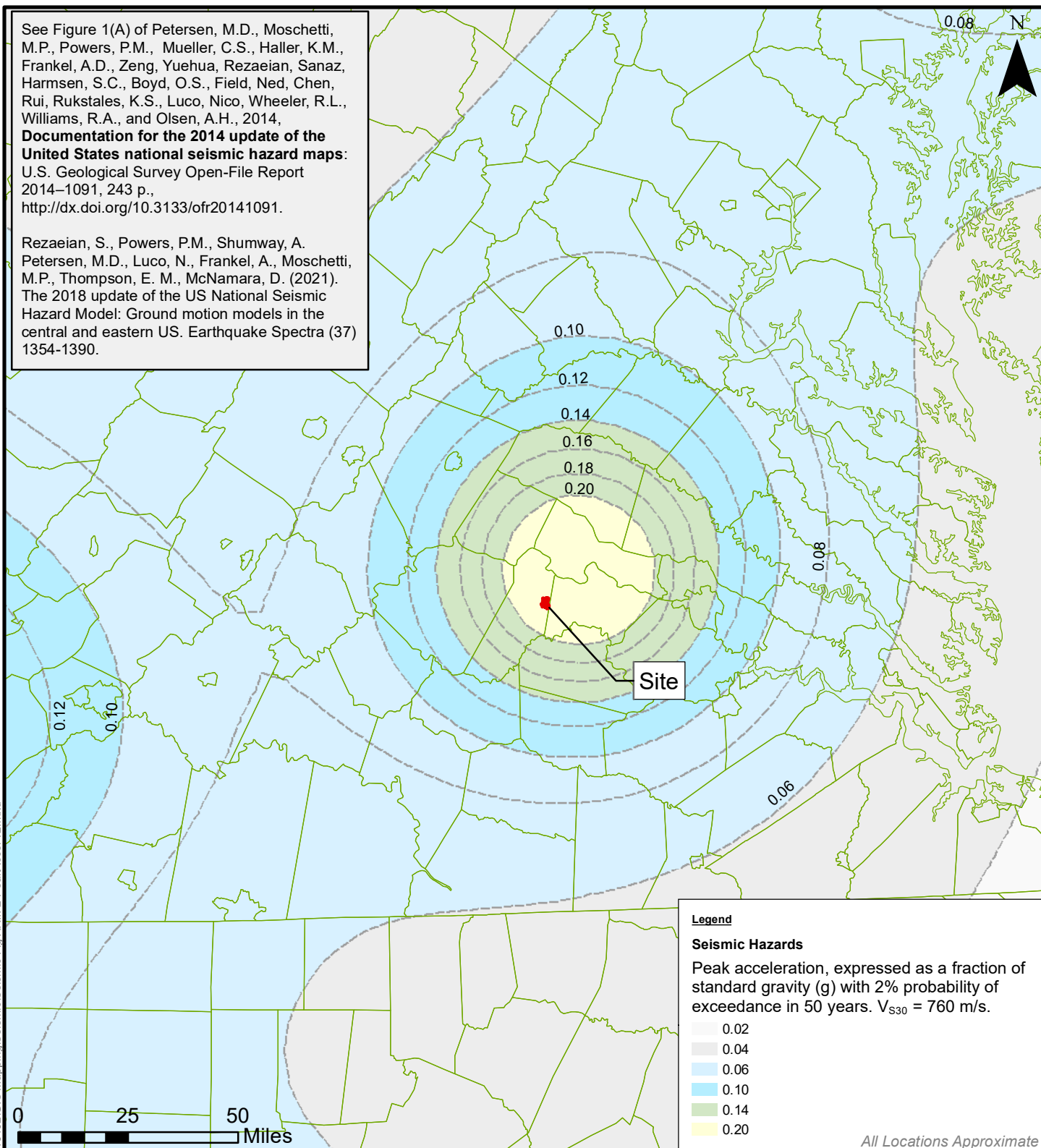
Raleigh, NC
Fayetteville, NC
Northern Virginia

DESIGNED: WDN
DRAWN: SMF
CHECKED: KEB
DATE: 12-09-19

**FIGURE
XXIII-1**

See Figure 1(A) of Petersen, M.D., Moschetti, M.P., Powers, P.M., Mueller, C.S., Haller, K.M., Frankel, A.D., Zeng, Yuehua, Rezaeian, Sanaz, Harmsen, S.C., Boyd, O.S., Field, Ned, Chen, Rui, Rukstales, K.S., Luco, Nico, Wheeler, R.L., Williams, R.A., and Olsen, A.H., 2014, **Documentation for the 2014 update of the United States national seismic hazard maps:** U.S. Geological Survey Open-File Report 2014-1091, 243 p., <http://dx.doi.org/10.3133/ofr20141091>.

Rezaeian, S., Powers, P.M., Shumway, A., Petersen, M.D., Luco, N., Frankel, A., Moschetti, M.P., Thompson, E. M., McNamara, D. (2021). The 2018 update of the US National Seismic Hazard Model: Ground motion models in the central and eastern US. *Earthquake Spectra* (37) 1354-1390.



**Seismic Hazards:
Probabilistic Peak
Ground Acceleration**

Green Ridge Recycling
and Disposal Facility
Cumberland Co., Virginia

SCALE: 1:2,000,000

PROJECT: 18020117-010102



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**FIGURE
XXIII-2**